

Services Liberalization in Preferential Trade Arrangements

The Case of Kenya

Edward J. Balistreri

David G. Tarr

The World Bank
Development Research Group
Trade and Integration Team
January 2011



Abstract

Given the growing importance of commitments to foreign investors in services in regional trade agreements, it is important to develop applied general equilibrium models to assess the impacts of liberalization of barriers to multinational service providers. This paper develops a 55 sector applied general equilibrium model of Kenya with foreign direct investment and Dixit-Stiglitz productivity effects from additional varieties of imperfectly competitive goods or services, and uses the model to assess its regional and multilateral trade options, focusing on commitments to foreign investors in services. To assess the sensitivity of the results to parameter values, the model is executed 30,000 times, and results are reported as confidence intervals of the sample distributions.

The analysis reveals that a 50 percent preferential reduction in the ad valorem equivalents of barriers in

all business services by Kenya with its African partners would be somewhat beneficial for Kenya. If a preferential agreement with African partners is combined with an agreement with the European Union, the gains would more than triple the gains of an Africa only agreement. Multilateral reduction of services barriers, however, would yield gains about 12 times the gains of an agreement with the Africa region alone. These results suggest that preferential liberalization in the region is a valuable first step, but wider liberalization, with larger partners and liberal rules of origin or multilaterally, will yield much larger gains due to providing access to a much wider set of services providers. The largest gains would come from domestic regulatory reform in services, as this would almost triple the gains of multilateral liberalization.

This paper is a product of the Trade and Integration Team, Development Research Group. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The author may be contacted at dtarr@worldbank.org.

The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

Services Liberalization in Preferential Trade Arrangements: The Case of Kenya

by

**Edward J. Balistreri
and
David G. Tarr**

Edward J. Balistreri is in the economics department at Colorado School of Mines; and David G. Tarr (corresponding author, dtarr@Worldbank.org) is a consultant for DECRG, the World Bank. We thank Ana Margarida Fernandes, Jesper Jensen, Thomas Rutherford, Christopher Worley, Josaphat Kweka, Nora Dihel, Francis Ng and Grigol Modebadze for their contributions to this project, and Paul Brenton, Paulo Zacchia and Maryla Maliszewska for valuable suggestions. Financial support from the Bank-Netherlands Partnership Program under the Regional Services in Africa project is gratefully acknowledged. The views expressed are those of the authors and do not necessarily reflect those of the World Bank, its Executive Directors, the Government of Kenya or those acknowledged.

Services Liberalization in Preferential Trade Arrangements: The Case of Kenya

by

**Edward J. Balistreri, Colorado School of Mines
and
David G. Tarr, The World Bank**

I. Introduction

Both economic theory and empirical literature have shown that wide availability of business services results in productivity gains to the manufacturing sector and contributes to its international competitiveness.¹ International commitments to national treatment and market access for foreign investors in key business services sectors may help developing countries obtain better access to these services that contribute to the productivity gains. Some developing countries, however, are hesitant to make substantial multilateral commitments, but may be more inclined to proceed in regional arrangements with other neighboring developing countries, rather than with a major Northern partner. Commitments in services, however, are often limited in South-South arrangements.

¹ Arnold et al. (2007), Fernandes (2007) and Fernandes and Paunov (2008) have provided econometric estimates of the gains from services liberalization. Marshall (1988) shows that in three regions in the United Kingdom (Birmingham, Leeds and Manchester) almost 80 percent of the services purchased by manufacturers were bought from suppliers within the same region. He cites studies which show that firm performance is enhanced by the local availability of producer services. In developing countries, McKee (1988) argues that the local availability of producer services is very important for the development of leading industrial sectors.

Both the urban economics literature (Vernon, 1960; Chinitz, 1961) and the modern economic geography literature (e.g., Krugman, 1991; Fujita, Krugman and Venables, 1999) have focused on the fact that related economic activity is economically concentrated due to agglomeration externalities (e.g., computer businesses in Silicon Valley, ceramic tiles in Sassuolo, Italy). Evidence comes from a variety of sources. Ciccone and Hall (1996) show that firms operating in economically dense areas are more productive than firms operating in relative isolation. Caballero and Lyons (1992) show that productivity increases in industries when output of its input supplying industries increases. Hummels (1995) shows that most of the richest countries in the world are clustered in relatively small regions of Europe, North America and East Asia, while the poor countries are spread around the rest of the world. He argues this is partly explained by transportation costs for inputs since it is more expensive to buy specialized inputs in countries that are far away from the countries where a large variety of such inputs are located.

Since the early 1990s, regional trade agreements have surged; 283 have been notified to the WTO and were in force as of February 2010.² Given the inclusion of services in modern FTA agreements negotiated with the EU, the US and in some other agreements, economists need to be able to assess the impact of services commitments as part of their advice to governments regarding preferential trade agreements. Services commitments in regional agreements could lead to substantial productivity improvements. But is there an analogy to trade diversion in goods whereby preferential commitments in services could be immiserizing? Are developing countries likely to obtain substantially larger gains from an agreement with a developed country, rather than a developing country? How do the gains of preferential versus global liberalization compare?

Given that preferential trade liberalization discriminates against excluded countries, it is well known from the vast theoretical literature that preferential liberalization of goods may lead to either gains or losses of welfare. Perhaps motivated by this uncertainty of outcomes of their agreements, policy-makers have expressed considerable demand for analysis of these agreements. Applied modelers have responded with applied general equilibrium models that focus on goods. So the literature now contains a substantial number of studies that examine regional agreements in goods.³ But this paper and the Jensen and Tarr (2010) paper are the first

²See http://www.wto.org/english/tratop_e/region_e/region_e.htm. This does not include a significant number of regional agreements that are in force (among developing countries) that have not been notified to the WTO.

³ The more prominent studies include Harris (1984), Cox and Harris (1986), Harrison, Rutherford and Tarr (1996), Smith and Venables (1988), Baldwin, Forslid and Haarland (2000), several in the Francois and Shiells (1994) volume, Levy and van Wijnbergen (1995), Harrison, Rutherford and Tarr (1997a), Rutherford, Rutstrom and Tarr (1993), Rutherford, Rutstrom and Tarr (1995), Harrison, Rutherford and Tarr (2002), Rutherford and Tarr (2003) and Harrison, Rutherford, Tarr and Gurgel (2004). See Jensen and Tarr (2010) for a review of this literature.

numerical studies of regional arrangements that assess the impact of commitments to multinational firms who will undertake foreign direct investment in services.⁴

Given substantial demand by governments for advice on their prospective trade policies in the regional and multilateral arenas, it is unfortunate that the profession does not have a framework for assessing the ex ante welfare impact of preferential reduction of barriers against foreign direct investment in business services. We attempt to fill that gap in this paper. Crucial to the analysis, we incorporate the Dixit-Stiglitz-Ethier mechanism of endogenous productivity gains from additional varieties of imperfectly produced goods and services.

Jensen and Tarr (2010) have shown that if domestic firms capture rents from the barriers against multinational providers of services, then these rents are analogous to tariff losses in goods, and losses may occur from preferential liberalization of services. Moreover, with imperfect competition, preferential liberalization will lead to a gain of varieties from the partner countries, but a loss of varieties from excluded countries; the lost varieties can lead to a net loss of welfare. We simulate examples of cases where there is a loss of welfare due to the loss of varieties and show how key elasticities in the model influence the result.

⁴ Earlier papers that examined the impact of barriers to foreign direct investment in services include the following. Markusen, Rutherford and Tarr (2005) developed a stylized model where foreign direct investment is required for entry of new multinational competitors in services, but they did not apply this model to the data of an actual economy. Brown and Stern (2001) and Dee et al. (2003) employ multi-country numerical models with many of the same features of Markusen, Rutherford and Tarr. Their models contain three sectors, agriculture, manufacturing and services, and are thus also rather stylized. The Dixit-Stiglitz endogenous productivity effect from the impact of service sector liberalization on product variety is not mentioned in the results of Brown and Stern and are interpreted as of little relevance in Dee et al.⁴ Konan and Maskus (2006) develop a small open economy constant returns to scale model with an initial monopoly in services sectors that results in monopoly rents and increased costs. They examine the impact of exogenously allowing additional firms to enter. The papers by Jensen, Rutherford and Tarr (2007) and Rutherford and Tarr (2008) on Russian WTO accession are the closest to this model; but there was only one aggregate rest of the world in those models, so there was no possible consideration of regional impacts in those papers.

Kenya is an example of a country facing most of the policy choices mentioned above. In many of its business services sectors, including maritime and road transportation, banking, insurance and professional services, the regulatory regime imposes significant burdens on the cost of providing services, both by Kenyan service providers and by multinationals. In 2010 it was involved in negotiations of commitments in services in various regional arrangements, including the Economic Partnership Agreements with the European Union, COMESA and the East African Customs Union.⁵ And in the context of its international negotiations under the Doha Development Agenda, Kenya may be called upon to make further commitments in the business services area. Kenya is proceeding cautiously regarding services commitments in all these areas, but is taking steps to adopt a mutual recognition agreement in professional services within the East African Customs Union.

In this paper we develop a 55-sector small open economy comparative static computable general equilibrium model of Kenya that we believe is appropriate to evaluate the impact of Kenyan liberalization of services barriers. We build on the model of Balistreri, Rutherford and Tarr (2009), but we decompose the rest of the world into three regions: the European Union; our Africa region; and the Rest of the World. All foreign regions are sources of foreign direct investment in some of the business services sectors.

We find that a 50 percent preferential reduction in the ad valorem equivalents of barriers in all business services with respect to its African regional partners would be slightly beneficial for Kenya in our central elasticity case. But an agreement with the EU is worth more than twice as much as an agreement with the Africa region, and if preferential liberalization with the Africa region is combined with an agreement with the EU, the gains would more triple. If the

⁵ See table 1 for a list of COMESA (Common Market of East and Southern Africa) and East African Customs Union countries.

liberalization of business services commitments is extended to all foreign partners (called “Unilateral” in the tables), the gains would increase by twelve times compared with an African agreement alone. Thus, these results suggest that preferential liberalization in the region is a valuable first step, but wider liberalization, with larger partners or multilaterally will yield much larger gains due to providing access to a much wider set of services providers.

Finally, we estimate that a serious effort to reduce non-discriminatory regulatory barriers (that is, barriers that raise the costs of Kenyans as well as foreign services providers in Kenya) would almost triple the benefits of multilateral liberalization in Kenya.

Multilateral liberalization yields larger gains than preferential liberalization since with preferential liberalization Kenya will not obtain additional service sector suppliers from excluded countries, and, in fact, Kenya will suffer losses of service sector suppliers in excluded countries. Moreover, we summarize research below that shows that small countries gain more technological spillovers from trade with technologically advanced countries (at least in research and development intensive products). Our model allows for differentiated rates of technological spillover by region and product, and this is the main explanation for why the estimated gains from a preferential agreement with the EU will yield larger gains for Kenya than a preferential agreement with the African region.

Combining African regional liberalization with regional liberalization with the EU would capture the gains from agreements with both regions. Kenya could combine an agreement with the EU and the Africa region with liberal rules of origin, and the results would then come closer to the gains from unilateral liberalization with the whole world.

We devote considerable attention to the sensitivity of our results to uncertainty in the parameters. First, to understand the model better, we conduct piecemeal sensitivity of the results, where we isolate the impact of each of the parameters to ascertain which parameters most strongly impact the results. Second, to assess the robustness of the results to parameter uncertainty, we conduct systematic sensitivity analysis, where we execute the model 30,000 times. Each simulation is based on a random draw of all the parameter values; we then present sample distributions and sample confidence intervals of the key variables.⁶ Regarding Kenya's preferential arrangement with the Africa region, we find, from the systematic sensitivity analysis, that there is a 9.5 chance that Kenya would lose. If Kenyans are assumed to capture the rents from barriers in services, then the mean estimate is that Kenya would lose.

We conduct sensitivity on a range of values of key parameters that determine the productivity impacts in imperfect competition. In the Kenya-Africa scenario, we show that there is a set of plausible parameter values that result in sufficient loss of varieties from the rest of the world and the EU region that there would be negative welfare effects for Kenya. This shows that under imperfect competition there is an extension of the trade diversion results of perfect competition.

The paper is organized as follows. In section II, we provide an overview of the Kenyan services sectors. We discuss how we estimated the tariff equivalents of the barriers in services in section III. We provide an overview of the model in section IV and a discussion of the data in section V. The central results are presented in section VI and sensitivity results are presented in section VII. Given the initiative of the East African Customs Union to begin to include services

⁶ The systematic sensitivity analysis has been conducted with the range of parameters values shown in table 22, with the exception of the elasticity of firm supply with respect to price. For this latter elasticities, the systematic sensitivity analysis was done with these elasticities equal to 2 for the Africa and Kenyan regions, ten for the EU and 15 for the Rest of the World (for all sectors).

in their agreements by negotiating mutual recognition agreements in professional services, we focus on a range of possible policy options in professional services. These are presented in section VIII. Conclusions are presented in section IX. In appendix A, we discuss the trade and tariff data in some detail. We document the calculation of ownership shares by sector and region in appendix B. How we obtained estimates of the Dixit-Stiglitz elasticities in goods is described in appendix C. The explanation of the estimation of the ad valorem equivalents of barriers in professional services, done by Nora Dihel and Josaphat Kweka, is explained in appendix D.

II. Overview of the Kenyan Service Sectors

In this section, we summarize the key institutional and policy issues in telecommunications, banking, insurance and transportation. This discussion is based on several policy notes written on the Kenyan business services sectors.

Transportation

One bright spot in the Kenyan transportation network is its air transportation services. In recent years, Kenya allowed private sector development (both Kenyan and foreign) to develop the air transportation links. The efficient air transportation services facilitate the important tourism sector and have been instrumental in the development of the Kenyan cut flower industry, which in turn has contributed to growth and poverty reduction.

However, Kenya's port, rail and road transportation facilities are significant problems for transportation of its goods and for the competitiveness of its exports (for details see Helu, 2007; Ochieng, 2007; and World Bank, 2007). Its principal port, Mombassa, is plagued by poor infrastructure and complicated bureaucratic procedures. As a result, it takes an average of two weeks to clear a container at the port and more than four weeks for over 5 percent of the containers. The cost of importing a container into Kenya exceeds USD 1300, while it is under USD 1,000 per container in Tanzania and South Africa

and under USD 500 per container in Malaysia and Singapore.⁷ Uncertainty over delivery times is a significant cost burden on manufactured exports. The port at Dar es Salaam, Tanzania, is regarded as more efficient and container throughput has been growing much faster there.

Due to a lack of investment, Kenya's railways have significantly declined and are considered rather poor providers of freight transportation services since the 1980s.⁸ Road transportation is the primary means of overland transport. But some sections of the key "Northern Corridor" are in very poor condition.

Kenya's problems with its ports, rail and road transportation facilities were highlighted by Kenya's ranking on the international Logistics Perception Index of 2004.⁹ Of the 70 countries in the 2004 survey, Kenya was ranked as the least logistically friendly (World Bank, 2007). In Africa, the survey included South Africa, Zambia, Ghana and Nigeria. For 2006, the survey expanded to include 150 countries, and Kenya ranks at number 75--below several African countries, but above average for the region.

Telecommunications

As of 2007, Kenya's telecommunications services were expensive compared with other Sub-Saharan African countries and even more when compared with those of East and South Asia. Relative to countries with comparable income, Kenya had fewer fixed lines per capita, less than half the level of international calls per subscriber and higher Internet charges. Perhaps more important is the low efficiency of service provision (see World Bank, 2007, pp.45-47). Kenya currently requires that telephone companies must be at least 30 percent owned by Kenyan nationals. Problems related to the licensing of the third mobile telephone provider¹⁰ and the "Second National Operator" were primarily due to this

⁷ World Bank staff estimates.

⁸ In the hope of improved performance, Kenya's railways were turned over to Rift Valley Railways, a South African company, in November 2006.

⁹ The Logistics Perception Index measures the perceptions of managerial level personnel of international freight forwarding companies. It is published by the Global Facilitation Partnership for Transportation and Trade and available at: www.gfptt.org.

¹⁰ Regarding the third mobile telephone operator, a consortium of a local investor (Kenya National Federation of Cooperatives, KNFC) and foreign investors (Econet Wireless) won the tender in February 2004. But the consortium was put together to meet the 30 percent local ownership requirement, not because of business reasons. Citing deals

restraint. In fact, the Government has acknowledged that the 30 percent ownership requirement is delaying licensing of additional telecom operators.¹¹

By the end of 2009, however, the duopoly of Zain and Safaricom was broken by the addition of two additional operators to the market: Orange Kenya and Essar Telecom Kenya. Subscribers increased to 19.4 million, or 49.7 percent of the population, almost all of whom were prepaid subscribers. About 85 percent of the population lived in a region where service was provided. According to the Communications Commission of Kenya, prices of mobile services were declining due to competition among the four operators. Safaricom was the leader in mobile banking software for its telephones and thus succeeded in capturing back significant market share.

Data transmissions are especially expensive by international standards. The primary explanation for the high cost of these services is that until recently East Africa was the only major coastline in the world without access to a fiber-optic cable network. In early 2008, these services were provided by satellite services, which are more expensive than fiber optic seabed cable. However, the completion of the SEACOM and TEAMS fiber optic cable systems in 2009 and the expected operation of the EASSy system in mid-2010 should lower the costs of internet and data transmission services. A reduction in the costs of internet transmission services will likely result in more internet service users. More internet users will likely allow achievement of economies of scale in production that would further reduce costs. However, according to one expert, as of early 2010, the main consequence of the TEAMS and SEACOM project completion has been increasing speed, but not lowering of costs.¹²

While there are obviously serious economic problems in the telecom sector, the government has implemented significant reforms in the sector in the last ten years. The government's strategy for the

made by a previous CEO of KNFC, KNFC at one point wrote to the Communications Commission of Kenya (CCK) withdrawing from the consortium. KNFC later withdrew its letter of objection, but lost its controlling share of the consortium. CCK, nonetheless, awarded the license to Econet Wireless and court battles ensued. The Government eventually suspended the entire CCK board and its Director General, and suspended the license of Econet. In April 2007, Econet has agreed to withdraw its court case and settle the matter out of court. Ultimately, it began operating under the brand name "Yu" and changed its name to Essar Telecom Kenya in April 2009.

¹¹ "SNO to get a year to meet local ownership rule," *The Saturday Standard*, Business section, April 14, 2007.

¹² See www.moseskemibaro.com/2010/01/02/a-review-of-kenyas-ict-position-in-2009/

sector is outlined in the Postal and Telecommunications Policy Statement of 1997.¹³ The strategy outlines a more liberal and private sector led strategy designed to optimize the sector's contribution to economic growth of Kenya (Matano and Njeru, 2007). The Kenya Communications Act of 1998 created the Communication Commission of Kenya as an independent regulator of the sector. The monopoly rights of Telekom Kenya Ltd expired on June 30, 2004. Since then significant competition has been introduced into the sector and the Communication Commission of Kenya introduced the modern and efficient "Unified Licensing Framework" for licensing of telecommunications companies. The estimates of this paper can be taken as an assessment of the effective implementation of this reform program.

Banking and Insurance

Banking. Relative to other countries in Africa, Kenya has a well developed financial sector. The cost of credit does not appear to be a major constraint for large enterprises. Nonetheless, medium, small and micro enterprises have severe problems accessing credit.¹⁴ Only about 1.5 percent of the credit these enterprises receive is from banks, and about 90 percent of them have no access to credit. Their problems accessing credit is because of: the high costs to banks of evaluating and monitoring credit to small enterprises; the absence of credit rating agencies, deficiencies in the legal system that make enforcement of debt contracts difficult and push collateral requirements too high for small firms; many small firms lack the capacity to process bank paperwork; and many small firms do not have access to insurance that would significantly reduce the risk to banks and the collateral required.

Foreign banks can operate in Kenya, either by acquiring a Kenyan bank or by obtaining a license to operate as a Kenyan affiliate bank of a multinational bank. In practice, affiliates of multinational banks are provided full market access and national treatment, but Kenya has not "bound" this practice at the WTO. The European Union has requested that Kenya commit to national treatment of foreign investment

¹³ This statement is consistent with the government's Economic Recovery Strategy for Wealth Creation (ERS)

¹⁴ Despite the credit problems, it is the medium and small enterprises that are the fastest growing part of the Kenyan economy. They increased their share of GDP from 13.8 in 1993 to 18.4 in 1999.

in the sector by binding this commitment at the WTO (Kiptui, 2007). Branch banking by foreign banks, however, is not permitted.

Insurance. The insurance market in Kenya is small, but is considered one of the more developed in Africa. Similar to banking issues, however, medium, small and micro enterprises have little access to insurance (World Bank, 2007). Regarding the regulatory environment, cross border provision of insurance is limited to cargo insurance and reinsurance services. In addition, the ownership of an insurance company must be at least one-third Kenyan and one-third of the members of the Boards of Directors must be Kenyan.

Distribution Services

Distribution services are the wholesale and retail trade sector of the economy. In Kenya in 2004 this sector accounted for about 10 percent of GDP, there were 217,000 retail outlets and about 66 percent of these retail outlets were either small retail stores or kiosks. Only one-half a percent of the outlets are super markets or very large stores. It is necessary to distinguish agricultural marketing from the marketing of manufactured goods.

Prior to 1993, many agricultural products, including maize, coffee and tea had to be sold to State Marketing Boards. The State Marketing Boards had an exclusive right to purchase, distribute and import these products. Since the reforms of 1993, farmers are now free to sell to private traders or to mills or the final consumer directly, but they still have the option to sell to the State Marketing Board if they choose. On the other hand, distribution of manufacturing goods has traditionally been handled by the private sector.

Presently numerous business licenses are required and many are considering damaging forms of government regulation (Onyango, 2007). The Government established a committee to review 1335 licenses. Draft laws and regulations have been prepared to implement the recommendations of the committee but have not yet been implemented as of mid-2007. In addition, restrictions on large scale outlets, shop opening hours and zoning restraints on business have been criticized as unnecessary burdens on business.

With respect to discriminatory restraints on foreign investors, Kenya requires that foreigners conduct business only in areas designated as general business areas. Local partners are encouraged, but not required. Expatriates employees are limited and the company must demonstrate that the skills are not available locally.

Professional Services

There are rather severe restrictions on the rights of foreigners to operate with a license in many of the professional services sectors, including legal, accounting, auditing and engineering services. The East African Customs Union is making its first foray into commitments in the services areas by encouraging mutual recognition agreements among the members. In appendix D, we provide details on the situation in engineering services sectors.

III. Estimation of the Tariff Equivalence of the Regulatory Barriers

Estimates of the ad valorem equivalents of the regulatory barriers in services are key to the results. In order to make these estimates, we first need to assess the regulatory environment in the services sectors in our model. We commissioned a 54 page survey of the regulatory regimes in key Kenyan business services sectors, namely, insurance, banking, fixed line and mobile telecommunications services and maritime transportation services.¹⁵ We supplemented this information based on a good set of studies on the services sectors that were presented at the conference on “Trade in Services” in Nairobi, Kenya on March 26, 27, 2007. In particular, we examined the papers by: Kiptui (2007) on financial services; Ndaro (2007) on communication services; Helu (2007) on maritime services; Ochieng (2007) on transport services; and Oresi (2007) on railway services. The study by the World Bank (2007) provided additional detail on the key issues in the sectors and the Telecommunications Management Group (2007) provided extensive details on telecoms. Tarr (2007a, 2007b) summarized this information in telecommunications

¹⁵ We thank Ms. Sonal Sejpal of the law firm of Anjarwalla & Khanna Advocates for leading this research effort.

and transportation. These questionnaires and papers provided us with data and descriptions and assessments of the regulatory environment in these sectors.

Mircheva (2007) then estimated the ad valorem equivalents of barriers to foreign direct investment in fixed line and mobile telecommunications, banking, insurance and maritime transportation services. The process involved converting the answers and data of the questionnaires into an index of restrictiveness in each industry. Mircheva followed the methodology of Kimura, Ando and Fujii (2004a, 2004b, 2004c) to generate these estimates. In the case of professional services, we used engineering services as a proxy for all professional services.¹⁶ The details of the regulatory regime and the scoring are listed as appendix D.

This methodology further involves building on the estimates and methodology explained in the volume by C. Findlay and T. Warren (2000), notably papers by Warren (2000), McGuire and Schulele (2000) and Kang (2000). For each of these service sectors, the authors evaluated the regulatory environment across many countries. The price of services is then regressed against the regulatory barriers to determine the impact of any of the regulatory barriers on the price of services. Mircheva (and Kweka in the case of engineering services) then assumed that the international regression applies to Kenya in the case that the above mentioned restrictiveness indexes are used. Applying that regression and their assessments of the regulatory environment in Kenya from the questionnaires and other information sources, she estimated the ad valorem impact of a reduction in barriers¹⁷ both for discriminatory and non-discriminatory barriers. Mircheva then weighted her fixed line and mobile telecommunications estimates by their market shares to obtain her estimate for communications. The results of the estimates of the ad valorem equivalents of the barriers are listed in table 4.

In the case of professional services, we used engineering services as a proxy for all professional services. In engineering services, we have the regression results from the paper by Ngyuen-Hong (2000). Based on an international data set, he estimates the ad valorem equivalents of barriers on trade in engineering services. No such estimates are available for other

¹⁶ The estimates were done by Josaphat Kweka, senior economist in the World Bank office in Tanzania in collaboration with Nora Dihel, Trade Coordinator for East Africa in the World Bank.

¹⁷ Warren estimated quantity impacts and then using elasticity estimates was able to obtain price impacts. The estimates by Mircheva that we employ are for “discriminatory” barriers against foreign direct investment.

professional services. Since the methodology we employ requires the existence of a cross-country regression estimate of the impact of barriers to foreign direct investment, we must use engineering services as our proxy. The scoring was done by Josaphat Kweka, senior economist in the World Bank office in Tanzania. The details of the regulatory regime and the scoring are listed as appendix D.

IV. Overview of the Model

This paper builds on the algebraic structure of the model of Balistreri, Rutherford and Tarr (2009). Here we provide a general description of the structure described there and provide more details where we depart from that structure. There are 55 sectors in the model shown in table 1. Primary factors include skilled, semi-skilled and unskilled labor; mobile capital; sector-specific capital in imperfectly competitive sectors; and primary inputs imported by multinational service providers, reflecting specialized management expertise or technology of the firm. The existence of sector specific capital in several sectors implies that there are decreasing returns to scale in the use of the mobile factors and supply curves in these sectors slope up. We explain this further in the appendix.

As in Balistreri, Rutherford and Tarr (2009), there are three categories of firms in the model: (1) perfectly competitive goods and services sectors; (2) imperfectly competitive goods sectors; and (3) imperfectly competitive services sectors with foreign direct investment. The cost, production and pricing structures in the three categories differ widely. The principal extension is that we disaggregate the rest of the world region of Balistreri, Rutherford and Tarr (2009) into three regions: (1) the European Union; (2) the union of the East African Customs Union and COMESA, which we call our African region; and (3) the Rest of the World. In the imperfectly competitive sectors, this requires introducing different firm types with distinct cost structures for each region. We retain the small open economy model framework, so only Kenya is modeled fully.

Perfectly Competitive Goods and Services Sectors

Regardless of sector, all firms minimize the cost of production. In the *competitive goods and services sectors*, goods or services are produced under constant returns to scale and where price equals marginal costs with zero profits. This includes all 20 of the agriculture sectors and 19 manufacturing or services sectors, including some food processing sectors such as meat and dairy products and grain milling, and services such as construction, hotels and restaurants, postal communication, real estate, public administration, health and education. In these sectors, products are differentiated by country of origin, i.e., we employ the Armington assumption. All goods producing firms (including imperfectly competitive firms) can sell on the domestic market or export. Firms optimize their output decision between exports and domestic sales based on relative prices and their constant elasticity of transformation production function. Having chosen how much to allocate between exports and domestic sales, firms also optimize their output decision between exports to the three possible export regions, based on relative prices the three regions and their constant elasticity of transformation production function for shifting output between the regions.

Goods Produced Subject to Increasing Returns to Scale

Goods in these seven sectors are differentiated at the firm level. We assume that manufactured goods may be produced domestically or imported for firms in any region in the model. Firms in these industries set prices such that marginal cost (which is constant) equals marginal revenue; and there is free entry, which drives profits to zero. For domestic firms, costs are defined by observed primary factor and intermediate inputs to that sector in the base year data. Foreigners produce the goods abroad at constant marginal cost but incur a fixed cost of

operating in Kenya. The cif import price of foreign goods is simply defined by the import price, and, by the zero profits assumption, in equilibrium the import price must cover fixed and marginal costs of foreign firms. Domestic firms set prices using the Chamberlinian large group monopolistic competition assumption within a Dixit-Stiglitz framework, which results in constant markups over marginal cost for both foreign firms and domestic firms.

We have made one significant modeling extension in the imperfectly competitive sectors compared to the Balistreri, Rutherford and Tarr (2009) model. In the Balistreri, Rutherford and Tarr model, domestic firms faced a perfectly elastic demand curve on export markets and they exported at marginal costs. In this model, all imperfectly competitive domestic firms (both goods and services producers) face a downward sloping demand curve in each of their three export markets. Consistent with firm level product differentiation, we assume that the elasticity of demand in each of the export markets is the Dixit-Stiglitz elasticity of demand. Firms then set marginal revenue equal to marginal costs in each of the three export markets; then the export market contribute to the quasi-rents of the firm and affect the entry and exit decisions of firms.

Introducing downward sloping demand curves into the model means that there are possible terms of trade effects to consider in this model that were not present in the Jensen, Rutherford and Tarr model. Balistreri and Markusen (2009) have shown, however, that there should be virtually no role for optimal tariffs to exploit terms of trade effects. The reason is that, unlike perfectly competitive firms, imperfectly competitive firms are pricing such that marginal revenue equals marginal costs on export markets, which is the objective of optimal tariffs.

For simplicity we assume that the composition of fixed and marginal cost is identical in all firms producing under increasing returns to scale (in both goods and services). This assumption in our Dixit-Stiglitz based Chamberlinian large-group model assures that output per

firm for all firm types remains constant, i.e., the model does not produce rationalization gains or losses.

The number of varieties affects the productivity of the use of imperfectly competitive goods based on the standard Dixit-Stiglitz formulation. The effective cost function for users of goods produced subject to increasing returns to scale declines in the total number of firms in the industry.

Service Sectors That Are Produced under Increasing Returns to Scale and Imperfect Competition

These nine sectors are telecommunications, banking and insurance services, various transportation services and professional business services. In these services sectors, we observe that some services are provided by foreign service providers on a cross border basis analogous to goods providers from abroad. But a large share of business services are provided by service providers with a domestic presence, both multinational and Kenyan.¹⁸ Our model allows for both types of foreign service provision in these sectors. There are cross border services allowed in this sector and they are provided from abroad at constant costs—this is analogous to competitive provision of goods from abroad. Cross border services, however, are not good substitutes for service providers who have a domestic presence.¹⁹

Crucial to the results, we allow multinational service firm providers that choose to establish a presence in Kenya in order to compete with Kenyan firms directly. As in the goods

¹⁸ One estimate puts the world-wide cross-border share of trade in services at 41% and the share of trade in services provided by multinational affiliates at 38%. Travel expenditures 20% and compensation to employees working abroad 1% make up the difference. See Brown and Stern (2001, table 1).

¹⁹ Daniels (1985) found that service providers charge higher prices when the service is provided at a distance.

sectors, services that are produced subject to increasing returns to scale are differentiated at the firm level. Firms in these industries set prices such that marginal cost (which is constant) equals marginal revenue; and there is free entry, which drives profits to zero. We assume firm level product differentiation and employ the Chamberlinian large group monopolistic competition assumption within a Dixit-Stiglitz framework. Given our assumption on the composition of fixed and variable costs, we have constant markups over marginal cost for both foreign firms and domestic firms, i.e., no rationalization impacts.

For domestic firms, costs are defined by observed primary factors and intermediate inputs to that sector in the base year data. When multinationals service providers decide to establish a domestic presence in Kenya, they will import some of their technology or management expertise. That is, foreign direct investment generally entails importing specialized foreign inputs. Thus, the cost structure of multinationals differs from national only service providers. Multinationals incur costs related to both imported primary inputs and Kenyan primary factors, in addition to intermediate factor inputs. Foreign provision of services differs from foreign provision of goods, since the service providers use Kenyan primary inputs. Domestic service providers do not import the specialized primary factors available to the multinationals. Hence, domestic service firms incur primary factor costs related to Kenyan labor and capital only. These services are characterized by firm-level product differentiation. For multinational firms, the barriers to foreign direct investment affect their profitability and entry. Reduction in the constraints on foreign direct investment will induce foreign entry that will typically lead to productivity gains because when more varieties of service providers are available, buyers can obtain varieties that more closely fit their demands and needs (the Dixit-Stiglitz variety effect).

Evidence on the Role of Trade and FDI in Increasing Total Factor Productivity through Technology Transfer

Grossman and Helpman (1991) have developed models of economic growth that have highlighted the role of trade in a greater variety of intermediate goods as a vehicle for technological spillovers that allow less developed countries to close the technological gap with industrialized countries. Similarly, Romer (1994) has argued that product variety is a crucial and often overlooked source of gains to the economy from trade liberalization. In our model, it is the greater availability of varieties that is the engine of productivity growth, but we believe there are other mechanisms as well through which trade may increase productivity.²⁰ Consequently, we take variety as a metaphor for the various ways increased trade can increase productivity. Winters et al. (2004) summarize the empirical literature by concluding that “the recent empirical evidence seems to suggest that openness and trade liberalization have a strong influence on productivity and its rate of change.” Some of the key articles regarding product variety are the following. Broda and Weinstein (2004) find that increased product variety contributes to a fall of 1.2 percent per year in the “true” import price index. Hummels and Klenow (2005) and Schott (2004) have shown that product variety and quality are important in explaining trade between nations. Feenstra et al. (1999) show that increased variety of exports in a sector increases total factor productivity in most manufacturing sectors in Taiwan (China) and Korea, and they have some evidence that increased input variety also increases total factor productivity. In business services, because of the high cost of using distant suppliers, the close availability of a diverse set of business services may be even more important for growth than in goods. The evidence for this was cited in the introduction section.

Beginning with the path-breaking work of Coe and Helpman (1995), a rich literature now exists that shows that important mechanisms for the transmission of knowledge and the increase in total factor productivity are the purchase of imported intermediate goods and inward foreign direct investment. The literature shows that for small developing countries, trading with large technologically advanced countries is crucial for TFP growth.²¹ A summary of this literature is

²⁰ Trade or services liberalization may increase growth indirectly through its positive impact on the development of institutions (see Rodrik, Subramanian and Trebbi, 2004). It may also induce firms to move down their average cost curves, or import higher quality products or shift production to more efficient firms within an industry. Tybout and Westbrook (1995) find evidence of this latter type of rationalization for Mexican manufacturing firms.

²¹ Schiff et al., (2002, table 1) have shown that for R&D intensive sectors, trade with industrialized countries contributes significantly to total factor productivity in developing countries, but trade with developing countries

provided in Jensen and Tarr (2010, Appendix E). Given the importance of foreign direct investment in services in our model, we mention here that Arnold, Mattoo and Javorcik (2007) show that in the Czech Republic, services sector liberalization led to increased productivity of downstream industries, and the key channel through which reform led to increased productivity was allowing foreign entry. Fernandes and Paunov (2008) found a positive and significant effect of foreign direct investment in services on productivity growth in Chile. Fernandes (2007) finds a positive and significant effect of services liberalization in both finance and infrastructure on the productivity of downstream manufacturing in the fifteen Eastern European countries.

In our model, the parameter that reflects the ability of a region to increase total factor productivity through the transmission of new technologies is the elasticity of varieties with respect to the price. Based on the literature summary in Jensen and Tarr (2010, Appendix E), we assign central values to this elasticity based on the region and the research and development intensity of the sector. The assigned central values for these parameters by sector and region are in table 6B. We conduct extensive sensitivity analysis on this parameter, both piecemeal and systematic.

V. Data of the Model

Social Accounting Matrix

The key data source for our study is the social accounting matrix taken from Kiringai, Thurlow and Wanjala (2006). This is a social accounting matrix (SAM) for the year 2003. The table is very rich in agricultural detail, with 20 agricultural sectors. Given our focus on services, we found it necessary to disaggregate the single transportation sector into five sectors (based on value of output data of the various transportation sectors published in the *Economic Survey, 2006* for Kenya by the Central Bureau of Statistics (2007a, p. 198)) and the single financial services sector into insurance, and banking and other financial services, from data in Central Bureau of Statistics (2007a, pp. 95-98. We assumed that the input output structure for all sectors using these services was identical for the disaggregated sectors. A full listing of the sectors and factors of production is provided in table 1. Kiringai et al. (2007) also provide a

does not. On the other hand, for sectors that are low in R&D intensity, their results suggest that for technology diffusion trade with developing countries can be as important as trade with industrialized countries.

set of 20 household accounts integrated into the social accounting matrix. Of these 20 households, ten are rural and ten are urban, ranked according to income. Due to some problems with the consistency of the household data, however, we employ one representative household in this model.

Trade Data by Regional Partner and Sector

To obtain the shares of imports and exports from the different regions of our model, we used trade data for 2007 obtained from WITS access to the COMTRADE database. The regions of our model are Kenya, the European Union, the East African Customs Union plus COMESA and the Rest of the World. For the European Union, we took the 27 member countries as of 2007. In appendix A, we calculate and report data for the East African Customs Union and COMESA separately. For the East African Customs Union, we took Tanzania, Uganda, Rwanda and Burundi. Excluding those East African Customs Union countries that are also COMESA members, COMESA includes Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Libya, Madagascar, Malawi, Mauritius, Seychelles, Sudan, Swaziland, Zambia and Zimbabwe.²² Trade shares for the “Africa” region in our model are the sum of East Africa Customs Union plus COMESA. Rest of the World is the residual.

We mapped two digit sectors from the COMTRADE database into the sectors of our model. The exact mapping is defined in appendix A. We used Kenya as the reporter country for both exports and imports. Results for both exports and imports are reported in tables A2 and A3 of appendix A.

Tariff Data

Tariff and Sales Tax Data. We started with MFN tariff rates at the eight digit level taken from the website of the Kenyan government: www.kra.go.ke/customs/customsdownloads.php. These tariff rates were then aggregated to the sectors of our model, using simple averages.

We obtained data on the total taxes on imports and the total value of imports and took the ratio to obtain the average value of import taxes in the Kenyan economy. In 2005, this was 8.4 percent.²³ That is,

²² To avoid double counting we exclude from COMESA the members of the East African Customs Union.

²³ Economic Survey (2006, pp. 103, 115).

on average, Kenyan importers paid 8.4 percent of the value of imports on import taxes that did not apply to domestic production.

As we reported in Balestreri, Rutherford and Tarr (2009), the MFN tariff rates, multiplied times the trade flows, exceed the collected tariff rates. That is, using MFN tariff rates for all trade, the weighted average tariff rate exceeds the collected tariff rate of 8.4 percent for the economy as a whole. Thus, they exaggerate the protection received by Kenyan industry and agriculture. This is due to tariff preferences to regional partners and due to other preference items or tariff exemptions. We assume that zero tariffs apply on all imports from the East African Customs Union and from COMESA.²⁴ Thus, we apply the MFN tariff rates only on the trade flows from outside of these African regions (EU and Rest of World in our model) and take a weighted average tariff rate of the MFN rates on the non-East African regions. The resulting weighted average tariff rate on non-East African imports still exceeds 8.4 percent. We then proportionally reduced all the MFN tariffs in our model so that the estimated collected tariffs on imports from the EU and Rest of World divided by the total value of import is 8.4 percent.

Share of Market Captured by Multinational Service Providers

It was necessary to calculate the market share of multinational firms in the services sectors by region of the model. Take the banking sector as an example. We need to know the share of the market captured by Kenyan, EU, African and Rest of the World firms, where the countries in the regions are defined in table 1. This entailed acquiring a list of all banks operating in Kenya along with their market share, and, when the bank is owned by multiple parties, allocating the ownership across the regions of our model. The database Bankscope was sufficient for this task in most cases, but websites of the banks had to be consulted to allocate ownership shares in several cases. The results, by region and sector, are presented in table 6. Documentation

²⁴ Kenya agreed to implement zero tariffs on East African Customs Union imports as of January 1, 2005. See Michael-Stahl (2005).

of the results, with listing by firm, sector and region, and the data sources are presented in appendix B.

Share of Expatriate Labor Employed by Multinational Service Providers

The impact of liberalization of barriers to foreign direct investment in business services sectors on the demand for labor in these sectors will depend importantly on the share of expatriate labor used by multinational firms. We explain in the results section that despite the fact that multinationals use Kenyan labor less intensively than their Kenyan competitors, if multinationals use mostly Kenyan labor, their expansion is likely to increase the demand for Kenyan labor in these sectors.²⁵ We obtained estimates of the share of expatriate labor or specialized technology not available to Kenyan firms that is used by multinational service providers in Kenya from the survey mentioned above. We found that multinational service providers use mostly local primary factor inputs and only small amounts of expatriate labor or specialized technology. Our estimated share of foreign inputs used by multinationals in Kenya is presented in the table on sensitivity analysis.

Estimates of the Dixit-Stiglitz Elasticities of Substitution for Goods

It was necessary for us to obtain estimates of the Dixit-Stiglitz product variety elasticities of substitution for the imperfectly competitive sectors in our model. Christian Broda, Joshua Greenfield and David Weinstein (2006) estimated Dixit-Stiglitz product variety elasticities of substitution at the 3 digit level in 73 countries. Among the 73 countries, there were four in Sub-Saharan Africa: the Central African Republic, Madagascar, Malawi and Mauritius. We judged

²⁵ See Markusen, Rutherford and Tarr (2005) for a detailed explanation on why FDI may be a partial equilibrium substitute for domestic labor but a general equilibrium complement.

that Madagascar was the country closest in characteristics to Kenya, so we took the values of the elasticities estimated for Madagascar as a proxy for the elasticities for Kenya. We explain in appendix C, how we mapped the 3 digit elasticities for 130 goods sectors estimated by Broda et al. into the sectors of our model. The mapping and resulting elasticities by relevant sector in our model are shown in table C1.

VI. Results for Preferential Reduction of All Services Barriers—Central Elasticity Case

We execute several scenarios to assess the impacts of Kenya entering into a bilateral free trade agreement that includes services with the European Union, and similarly with the Africa region. In these scenarios we assume that Kenyan ad valorem equivalents of the barriers against foreign investors in services are reduced by 50 percent with respect to the region with which Kenya has an agreement. We assume that Kenya already offers tariff free access to goods originating from its African trade partners, so in the scenario where we evaluate the agreement with the Africa region we include only liberalization of discriminatory barriers against foreign investors in services. Insofar as combining preferential trade agreements could potentially reduce trade diversion inherent in separate agreements (see, e.g., Harrison, Rutherford and Tarr, 2002, 2004), we examine the impacts of the combination of free trade agreements with both the Africa region and the European Union. We compare these impacts with unilateral non-discriminatory liberalization. Finally, given our earlier result on the importance of reducing non-discriminatory barriers against investors in services, we examine the impact of a 50 percent reduction of non-discriminatory barriers against service providers combined with unilateral liberalization of discriminatory barriers.

As discussed in Jensen and Tarr (2010), who captures the rents from the barriers is very important for the welfare results. Consequently, for each policy scenario, we execute two versions of the model with our central elasticities. In one case, we assume that Kenyans do not capture any rents from the barriers. In the second scenario, we assume that the discriminatory barriers generate rents that are captured by Kenyans. In our systematic sensitivity analysis, in each of the 30,000 scenarios, we allow the share of rents captured by Kenyans to vary

stochastically between zero and one. In a section below, we focus on the impacts in professional services by considering the same set of policy experiments where we allow reduction in services barriers only in professional services.

Aggregate Effects

We first discuss (and present results in tables 7 and 8) our estimates of the full reform scenario in our central elasticities case. In these tables we present results on the impacts on aggregate variables including welfare, the real exchange rate, aggregate exports and imports, the return to capital, skilled labor and unskilled labor and the percentage change in tariff revenue. In order to obtain an estimate of the adjustment costs, we estimate the percentage of each of our factors of production that have to change industries.

Significant gains with the EU—deriving primarily from services liberalization. We estimate that the preferential arrangement with the EU that includes both goods and services would generate gains for Kenya of 0.7 percent of consumption with no initial rent capture and 0.5 percent of consumption if there is initial rent capture by Kenyans. The gains come primarily from the preferential liberalization of services, although the relative contribution is much larger with no initial rent capture. That is, the gains to Kenya from preferential liberalization of tariffs with the EU are invariant to the rent capture assumption at 0.2 percent of consumption. But, if there is initial rent capture, the gains to Kenya of preferential liberalization of services fall from 0.5 percent of consumption to 0.3 percent of consumption.

Small gains from preferential liberalization with the Africa region. In the case of preferential liberalization with the Africa region, the gains are smaller—0.3 percent of consumption in the case of no initial rent capture and 0.1 percent of consumption in the case of rent capture initially by Kenya. The agreement with the EU includes tariff reduction, while tariff free access in the Africa region is considered part of the status quo; so the appropriate scenario for comparison of the relative gains for Kenya is the scenario in the second column of the results tables, labeled “EU discriminatory services.” With no initial rent capture, the gains for Kenya of an agreement with the EU are 60 percent greater than the gains from an agreement with the Africa region. With initial rent capture, gains of an agreement with the EU are three times greater than the gains from an agreement with the Africa region. We show in the sensitivity section that

there is a possibility of losses from an agreement with the Africa region in the initial rent capture case.

Why are the gains larger for the agreement with the “northern” region. As we discussed above, trade with and FDI from large technologically advanced regions can be expected to lead to technology diffusion that increases total factor productivity. Although trade and FDI from small developing countries can contribute to technology diffusion, it has been estimated to do so to a significantly lesser extent, at least for research and development intensive sectors. The elasticity of the number of varieties (firms) with respect to price is the parameter in our model that captures that effect, and the values we have chosen are in table 6B.²⁶ Table 21 shows that we estimate that the number of varieties from the EU substantially increases as a result of preferential liberalization with the EU, while table 18 shows that the estimated expansion of varieties from the Africa region is much more modest in response to preferential liberalization with respect to the African region. We show in the sensitivity analysis below that this elasticity of supply parameter is very important for the results: preferential agreements in services are more likely to be beneficial the higher the supply elasticities of the partner country’s services suppliers and the lower the supply elasticities of the excluded countries services suppliers.

More substantial gains from combining the Africa FTA with a FTA with Europe. In tables 7 and 8, in the column labeled “EU-Africa FTA,” we show our estimates for the impacts of agreeing to a FTA with both the EU and the Africa region. The estimated gains are approximately the sum of the separate agreements. This shows that Kenya can significantly augment the gains it may realize from an agreement with the Africa region, by adding a FTA with the EU.

Harrison, Rutherford and Tarr (2002) found that, for Chile, the gains from combining free trade agreements would be more than additive. Harrison, Rutherford, Tarr and Gurgel (2004) found similar results for Brazil. That is, the gains of the two agreements combined exceeded the gains of the two separate agreements. The reason is that if Chile, for example, agreed to a free

²⁶ The elasticity of supply corresponds to the share of the sector’s costs that are due to a specific factor of production. In all of the imperfectly competitive sectors, we assume there are four specific factors: one for each region in the model. Then, as industry output expands, the price of the specific factor necessary for production of that variety increases, thereby increasing the cost of production of firms. Since the cost of production of firms increases as the industry supply increases, the supply curve of each region will slope up in each of these sectors. And higher cost shares of the specific factor will lead to less elastic supply curves in that sector.

trade agreement with the U.S., then competition from the U.S. would greatly reduce the trade diversion associated with an agreement with neighboring developing countries. But there are the possibilities of trade diversion with the rest of the world region, so the gains from combined agreements are not necessarily greater than the gains from the separate agreements.

Non-discriminatory liberalization would result in a five-fold increase in the gains compared with preferential liberalization with the EU. With non-discriminatory liberalization, Kenyans would be able to access goods and services from the least cost supplier in the world. This would eliminate all trade diversion losses, reduce any adverse terms of trade losses and result in the maximum number of new foreign varieties for productivity improvement from trade and FDI liberalization. Consequently, the gains are much larger in this case. Because the rest of the world has a much larger share of the goods market in Kenya than it enjoys in the services sectors, the gains from non-discriminatory liberalization come more from liberalization of goods than from services.

The largest gains come from reduction in the barriers that domestic as well as foreign firms face. Consistent with the work of Jensen, Rutherford and Tarr (2009) in a model with an aggregate rest of the world, we find that the largest gains for Kenya would come from liberalization of the non-discriminatory barriers in services. That is, when we estimate the impact of a 50 percent reduction in the non-discriminatory services barriers on top of unilateral liberalization of all discriminatory services barriers, the estimated gains are 10.3 percent of consumption with no rent capture or 7.0 percent of consumption with initial rent capture.

Sector Impacts

In table 9, we present results for the percentage change in output by sector for four scenarios: an FTA with the EU; and FTA with the Africa region; and FTA with the EU and the Africa region combined; and unilateral liberalization. Details of what is included in these scenarios are explained in table 7.

In general we see an expansion of the output of the business services sectors in all scenarios. Multinational firms in the business services sectors are located in the home country and their output is defined as part of industry output. Reduction of barriers against one partner generally reduces the number of firms from the other three regions in the model, but on balance the output of the sector expands. To see what happens to EU firms, versus Kenyan and other

firms, it is necessary to view the tables that report the change in the number of firms by scenario.

Outside of business services, we estimate that mining, coffee and other manufactured food sectors are the sectors that will expand the greatest. These sectors are intensive users of business services, such as transportation and banking services. Regulatory reforms will decrease the price and allow for quality improvements in these business services, which permits these sectors to operate more cheaply and offer better quality services.

Given that we assume that total employment and the capital stock are fixed in the medium term, if labor expands in some sectors, it must contract in other sectors. Given the large expansion in several sectors, especially services, we must have declines in others in the medium term. Although we estimate small declines in output in several sectors, especially those that use business services less intensively, the striking result is that there is very little output decline in response to any regional initiative. On the other hand, since we assume zero tariffs in our unilateral reform scenario, output declines are much more pronounced in some cases. Sugarcane, which is the one of the more highly protected sectors, is estimated to decline substantially along with wheat and rice in the unilateral scenario. The stark result from table 9 is that for sectors that experience output declines, the contractions are generally much more moderate in the regional preferential scenarios than in the unilateral scenario. This follows from the less substantial drop in overall protection to any sector in a preferential trade arrangement.

VII. Sensitivity Analysis

In this section we assess the impact of parameter values and key modeling assumptions on the results. Through our “piecemeal sensitivity analysis” we will determine the most important parameters for the results, and we will assess how important for the results are rent capture or additional varieties from reform in services sectors under increasing returns to scale. In the piecemeal sensitivity analysis, we change the value of a single parameter while holding the values of all other parameters unchanged at our central elasticity values. We present piecemeal sensitivity analysis of the two most relevant policy scenarios. In table 22, we examine the

prospective free trade agreement with the EU, and in table 23, we examine the agreement with the Africa region.

Given uncertainty of parameter values and the rent capture assumption, point estimates of the results may be viewed with skepticism. In our “systematic sensitivity analysis,” we execute 30,000 simulations. In each simulation, we allow the computer to randomly select the values of all parameters, subject to the specified probability distributions of the parameters. Through the systematic sensitivity analysis we will be able to assess how robust the results are and obtain confidence intervals of the results.

Rent Capture Assumption

In the row labeled “share of rents captured” we retain the increasing returns to scale assumption in the services sectors and selected goods sectors, but allow the initial rent capture share in the services sectors to be either zero (central value) or 1 (upper value). We see that there is approximately a 40 percent reduction in the welfare gain from a free trade agreement with the EU if rents are captured initially (from a welfare gain of 0.67 percent of consumption to 0.49 percent of consumption). In the case of an agreement with the African region, the gains fall even more dramatically, from a welfare gain of 0.25 percent of consumption to a gain of 0.05 percent of consumption in our central elasticity case.

Impact of Constant Returns to Scale—Possible Negative Welfare Effects

In the row labeled CRTS—share of rents captured—we assume constant returns to scale in all sectors, which eliminates the Dixit-Stiglitz externality from additional varieties. We allow the initial rent capture share in the services sectors to be either zero (central value) or 1 (upper value). We see that without the Dixit-Stiglitz variety externality, the gains from an agreement with the EU fall dramatically. With no initial rent capture, the gains for the EU agreement would be .09 percent of consumption, and would fall to negative values (-0.06 percent of consumption) with initial rent capture. In the case of an agreement with the Africa region, the gains are 0.14 percent of consumption with no initial rent capture and are negative (-0.06 percent of consumption) with initial rent capture.

Piecemeal Sensitivity Analysis

Four parameters stand out as having a strong impact on the results. The elasticity of substitution between firm varieties in imperfectly competitive services sectors, $\sigma(q_i, q_j)$ has a very strong impact. At the low end of the elasticity range, the estimated gains are almost 10 percent of consumption from a preferential agreement with the EU and 5 percent of consumption from an agreement with the Africa region. Following from the Le Chatelier principle, larger elasticities typically lead to larger welfare gains in response to welfare improving reforms, as the economy can adapt more readily. Unlike other elasticities, however, a lower value of $\sigma(q_i, q_j)$ increases the welfare gains. This is because lower values of this elasticity imply that varieties are less close to each other, so additional varieties are worth more. Since the policy shocks in goods are much less, the same elasticity variation in goods has a much smaller impact, but its impact is nonetheless significant. The elasticity of substitution between value-added and business services, $\sigma(va, bs)$, also has a strong impact. The better firms are able to substitute business services for labor and capital, the more the economy will gain from the reforms that reduce the quality adjusted price of business services. Finally, for the agreement with the EU, there is a strong impact from changes in the value of ε_{EU} , the elasticity of multinational service firm supply with respect to the price of output. For the agreement with Africa, there is a strong impact of the parameter ε_{AFR} . Larger values of this parameter mean that tariff preferences that open opportunities for EU service firms to provide new varieties, will not be so quickly choked by the increased cost of the specific factor required for EU firm expansion. We investigate the sensitivity of the results to changes in the value of this parameter in more detail below.

Impact of Partner and Excluded Country Elasticities of Multinational Service Firm Supply—Why It Is More Likely to Obtain Gains from Large Technologically Advanced Partners

In figures 1 and 2, we depict the impact and interrelationship of the elasticities of firm supply from partner and excluded countries. In figure 1, we examine the estimates for the welfare effects in Kenya of a 50 percent preferential reduction of barriers in services against African partners. On the vertical axis is the set of elasticities of firm supply of African partners with respect to price. We scale this set of elasticities from between one-half to twice their central values. On the horizontal axis we scale the central values of the elasticities of firm supply of all

excluded countries from one-half of their central values to twice their central values. Excluded regions are the EU and Rest of the World. In figure 2, we do analogous simulations, except that since the preferential liberalization is with the EU, the EU elasticities are on the vertical axis and we scale the elasticities of the African region and the Rest of the World on the horizontal axis. In the left hand side panel, we present results with no initial rent capture, but initial rent capture is shown on the right hand side panel.

Regarding preferential reduction of barriers with African partners, we see in figure 1 that, with initial rent capture, there is a significant range of elasticities that result in losses for Kenya. Without initial rent capture, however, there are gains for all these values.

We see from figures 1 and 2 that the gains to the home country increase the higher the elasticity of supply of firms in partner countries and the lower the elasticity of supply of firms in excluded countries, with the partner country elasticity being by far the more important. Preferential reduction of barriers, leads to an increase in firms (varieties) and productivity from partner countries, but a loss of service providers (varieties) from all excluded regions and the home country, results in a loss of productivity for sectors using these services. The lost productivity from lost varieties from the regions excluded and the home country from the preferential liberalization in services is analogous to the trade diversion losses in perfect competition. When firm elasticities in partner countries are high, the after tax price increase for firms in partner countries from preferential reduction of barriers induces a large increase in partner country varieties, boosting productivity. For excluded countries, the price decrease of partner countries shifts in demand for their products and lowers their price; but the lower price induces fewer lost varieties when firms in excluded countries have low elasticities. In addition to the variety impacts in imperfect competition, as explained above, in perfect competition the rent and terms of trade impacts reinforce the argument that high elasticities of partners and low elasticities of excluded countries increase the likelihood of welfare gains from a preferential agreement in services.

Systematic Sensitivity Analysis

In the systematic sensitivity analysis, we execute the model 30,000 times and harvest the results for desired variables. In each individual simulation, we allow the computer to select values of all the parameters in the model (the parameters in table 22), based on the specified

probability density functions (pdfs) of the parameters. We assume uniform probability density functions, with upper and lower values of the pdfs given by the upper and lower values in the piecemeal sensitivity analysis table. We include initial rent capture in the systematic sensitivity analysis, with the rent capture parameter allowed to take values between zero and one with a uniform pdf.

The results for preferential reduction of barriers with African partners on welfare, output and labor are shown in figures 3-5 and similar figures for the preferential trade agreement with the EU in figures 6-8.. The sample distribution of the welfare results for preferential reduction of barriers in services with the Africa region is depicted in figure 3. We find that in 1.9 percent of the 30,000 simulations yield a negative welfare result, which we interpret as a 1.9 percent probability that preferential liberalization with the Africa region will yield a negative result. A 95 percent confidence interval for equivalent variation as a percent of consumption is: 0.008 to 0.417 around a sample mean of .203.²⁷

The sample distribution of the welfare results for a free trade agreement with the EU that includes services are depicted in figure 6. In the 30,000 simulations, there are no negative values. A 95 percent confidence interval for equivalent variation as a percent of consumption is: 0.37 to 0.94 around a sample mean of 0.63.²⁸

In figures 4 and 7, we show “box and whisker” diagrams for the sample distribution of the percentage change in output by sector. Sectors are on the horizontal axis and the percentage change in output is shown on the vertical axis. The bars in the box are the means of the distributions. Fifty percent confidence intervals are depicted by the boxes, while the vertical lines show 95 percent confidence intervals.

The means of the systematic sensitivity results show a similar pattern to the point estimates regarding the expansion of the services sectors. While the confidence intervals are rather tight for most sectors, they reveal a large range of uncertainty for several sectors. With respect to the EU agreement, while the sign of the direction of change does not change within the 95 percent confidence interval, the confidence intervals of expected output change are large for other manufactured food, maritime transportation, coffee and mining (among the expanding sectors) and sugarcane, non-metallic products and other manufactures (on the negative side). For

²⁷ 90 percent and 99 percent confidence intervals are 0.033 to 0.384 and -0.029 to 0.479, respectively.

²⁸ 90 and 99 percent confidence intervals are 0.41 to .89 and 0.30 to 1.07, respectively.

several sectors, where the mean change in output is close to zero, notably wood and paper, and chemicals, 95 percent confidence intervals reveal that the estimated sign of the change is not robust. For the Africa agreement, it is remarkable how tight the 95 percent confidence intervals are for those sectors where the mean predicted change is small (with the exception again of wood and paper). Confidence intervals are much less tight for sectors with significant predicted changes, but the sign of the change does not change throughout the confidence intervals.

VIII. Results for Preferential Reduction of Barriers in Professional Services Liberalization

In these scenarios we consider the impact of a preferential reduction in barriers in professional services, but assume that there is no reduction of barriers in other services sectors. We execute the same policy scenarios that we executed in the earlier section, where all services barriers are reduced on a preferential basis. The results are shown in tables 24-26. In table 24, we assume no initial rent capture, but in table 25, we assume initial rent capture.

We find that preferential liberalization of professional services with respect to its African regional partners would result in small positive welfare gains (0.02 percent of consumption) in the case of no initial rent capture, but virtually no welfare impact with initial rent capture.²⁹ But, it may be seen as positive if it is an important first step toward wider liberalization. Preferential liberalization of professional services with the EU will yield positive gains of 0.06 percent of consumption (in the no initial rent capture case). If liberalization in professional services is extended to all foreign partners (called “unilateral” in the tables), the gains would increase to 0.16 percent of consumption.. Thus, these results suggest that preferential liberalization in the region may be a useful, but wider liberalization, with larger partners or multilaterally will yield much larger gains.

Finally, we estimate that the largest gains in professional services reform would come from a serious effort to reduce non-discriminatory regulatory barriers (that is, barriers that raise

²⁹ Taken to a third decimal place, the impact is negative with initial rent capture.

the costs of Kenyans as well as foreign professional services providers in Kenya). This would more than quadruple the benefits of multilateral liberalization in Kenya. These results are consistent with the work of Dihel *et al.*, (2010). They have documented extensive regulatory barriers in professional services in Kenya and other East African countries that prevent entry of potential suppliers and limit competition among existing professional service suppliers.

As we mentioned in section III, we used engineering services as a proxy for all services when we estimated the barriers and calculated the market shares of different regions. Experts in this field in East Africa have suggested that engineering services are likely less constrained than some other services, notably legal services. This would imply that the ad valorem equivalents of the barriers would be higher if averaged with the other more protected sectors, and the gains from non-discriminatory liberalization would be higher. In some other sectors, like accounting, there is a much greater foreign presence. With higher barriers, discriminatory liberalization with the Africa region in accounting could displace a larger number of varieties in a sector like accounting and increase trade diversion.

IX. Conclusions

In this paper we have developed an innovative small open economy computable general equilibrium model of the Kenyan economy that is capable of assessing the impact of the preferential liberalization of barriers against multinational service providers. We have provided a discussion of the welfare economics of services liberalization, in which we argue that it is likely that the gains from preferential reduction of barriers against multinational services will be larger if the partner region is large. We find that gains to Kenya from preferential reduction of barriers in services with the Africa region are negligible, and could be negative under some plausible parameter assumptions. We show that under imperfect competition with the Dixit-Stiglitz

variety externality, welfare losses from preferential reduction of services barriers are possible due to a loss of varieties from excluded countries. Gains from a free trade agreement with the EU that includes a preferential 50 percent reduction in the ad valorem equivalents of the barriers in the services sectors will produce significant gains for Kenya, deriving primarily from services commitments. Kenyan gains from liberalization with the EU region are considerably larger than the gains from an agreement with the African region because a small increase in the price to EU producers can be expected to induce a relatively large increase in the number of varieties. In addition, when rents are captured initially, the terms of trade loss on partner services and the lost rents on services from the Rest of the World are larger when partners have low supply elasticities. We have conducted extensive sensitivity analysis to determine confidence intervals for the results and found plausible ranges of key parameters that lead to estimated losses for preferential liberalization of services with the Africa region.

References

- Arnold, Jens, Aaditya Mattoo and Beata Javorcik (2007), "Does Services Liberalization Benefit Manufacturing Firms: Evidence from the Czech Republic," World Bank Policy and Research Working Paper Number 4109.
- Baldwin, Richard E., Forslid, Rikard and Haaland, Jan (1999), "Investment Creation and Investment Diversion: Simulation Analysis of the Single Market Programme," in R. Baldwin and J. Francois (eds.), *Dynamic Issues in Applied Commercial Policy Analysis*, Cambridge: Cambridge University Press.
- Balistreri, Edward J. and James Markusen (2009), "Sub-national differentiation and the role of the firm in optimal international pricing," *Economic Modelling*, 26(1), 47 - 62.
- Balistreri, Edward J., Thomas F. Rutherford and David G. Tarr (2009) "Modeling Services Liberalization: The Case of Kenya," *Economic Modeling*, Vol. 26 (3), May, 668-679.
- Broda, Christian and David Weinstein (2004), "Variety, Growth and World Welfare," *American Economic Review*, 94 (2), May, 139-144.
- Broda, Christian, Josh Greenfield and David Weinstein (2006), "From Groundnuts to Globalization: A Structural Estimate of Trade and Growth," National Bureau of Economic Research Working Paper No. 12512. Available at: <http://faculty.chicagobooth.edu/christian.broda/website/research/unrestricted/BrodaGroundnuts.pdf>

- Brown, Drusilla, Alan Deardorf, Alan Fox and Robert Stern (1996), "Liberalization of Services Trade," in W. Martin and L. A. Winters, eds., *The Uruguay Round and the Developing Countries*, Cambridge: Cambridge University Press.
- Brown, Drusilla and Robert Stern (2001), "Measurement and Modeling of the Economic Effects of Trade and Investment Barriers in Services," *Review of International Economics*, 9(2): 262-286.
- Central Bureau of Statistics (2007a), Economic Survey, 2006, Nairobi: Ministry of Planning and National Development, Republic of Kenya.
- Central Bureau of Statistics (2007b), Statistical Abstract, 2006, Nairobi: Ministry of Planning and National Development, Republic of Kenya.
- Chinitz, B. (1961), "Contrast in agglomeration: New York and Pittsburgh," *American Economic Review, Papers and Proceedings*, 51:279-89.
- Cox, David and Richard G. Harris (1986), "A Quantitative Assessment of the Economic Impact on Canada of Sectoral Free Trade with the United States," *The Canadian Journal of Economics*, Vol. 19 (3), August, 377-394.
- Daniels, P.W. (1985), *Service Industries: A Geographical Appraisal*, New York: Methuen & Co.
- Dee, Philippa, Kevin Hanslow and Tien Phamduc (2003), "Measuring the Costs of Barriers to Trade in Services," in Takatoshi Ito and Anne Krueger (eds.), *Trade in Services in the Asia-Pacific Region*, Chicago: University of Chicago Press.
- Dihel, Nora, Ana Margarida Fernandes, Aaditya Mattoo and Nicholas Strychacz (2010), "Reform and Regional Integration of Professional Services in East Africa," Economic Premise No. 32, September, The World Bank. Available at: www.worldbank.org/economicpremise.
- Dixit, A. and J. Stiglitz (1977), "Monopolistic Competition and Optimum Product Diversity," *American Economic Review*, 76(1):297-308.
- Ethier, W.J. (1982), "National and International Returns to Scale in the Modern Theory of International Trade," *American Economic Review*, 72(2):389-405.
- Fernandes, Ana M (2007), "Structure and performance of the services sector in transition economies," World Bank Policy and Research Working Paper Number 4357. Available at: http://econ.worldbank.org/external/default/main?pagePK=64165259&theSitePK=469372&piPK=64165421&menuPK=64166093&entityID=000158349_20070919101422
- Fernandes, Ana M and Caroline Paunov (2008), "Foreign direct investment in services and manufacturing productivity growth: evidence for Chile," World Bank Policy and Research Working Paper Number 4730. Available at: http://econ.worldbank.org/external/default/main?pagePK=64165259&theSitePK=469372&piPK=64165421&menuPK=64166093&entityID=000158349_20080929085154.
- Francois, Joseph and Clint Shiells (eds., 1994), *Modeling Trade Policy: Applied General Equilibrium Assessments of North American Free Trade*, Cambridge: Cambridge University Press.

- Fujita, Masahisa, Paul Krugman and Anthony J. Venables (1999), *The Spatial Economy: Cities, Regions, and International Trade*, Cambridge MA: MIT Press.
- Harris, Richard (1984), "Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Comp," *The American Economic Review*, Vol. 74 (5), December, 1016-1032
- Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr (1997), "Quantifying the Uruguay Round," *Economic Journal*, Vol 107 (444), September, 1405-1430.
- Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr (1993), "Trade Reform in the Partially Liberalized Economy of Turkey," *The World Bank Economic Review*, May.
- Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr. (1996), "Increased Competition and Completion of the Market in the European Community: Static and Steady-State Effects," *Journal of Economic Integration*, 11(3), September 1996, 332-365.
- Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr (1997a), "Economic Implications for Turkey of a Customs Union with the European Union," *European Economic Review*, 41(3-5), 861-870.
- Harrison, Glenn H., Thomas F. Rutherford, David G. Tarr and Angelo Gurgel (1997a) "Trade Policy and Poverty Reduction in Brazil," *The World Bank Economic Review*, Vol. 18, 289-317, 2004.
- Helu, Samuel (2007), "Maritime Services in Kenya," paper presented at the Trade in Services Workshop in Nairobi, Kenya, sponsored by the Ministry of Industry and Trade of Kenya and International Lawyers and Economists against Poverty, Nairobi, March 26, 27.
- Heston, Alan, Robert Summers and Bettina Aten (2006), Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, September.
- Holmes, T. (1995), "Localization of Industry and Vertical Disintegration," Federal Reserve Bank of Minneapolis.
- Hummels, D (1995), "Global Income Clustering and Trade in Intermediate Goods," Graduate School of Business, University of Chicago.
- Ikiara, Gerrishon K., Moses I. Muriira and Wilfred Nyangena (2000), "Kenya's Trade in Services: Should the Country Fully Liberalize," in *Services in the International Economy*, Robert Stern (ed.), Ann Arbor: University of Michigan Press.
- Jensen, Jesper, Thomas F. Rutherford and David G. Tarr (2007), "The Impact of Liberalizing Barriers to Foreign Direct Investment in Services: The Case of Russian Accession to the World Trade Organization," *Review of Development Economics*, Vol 11 (3), August, 2007, 482-506.
- Jensen, Jesper and David G. Tarr (2010), "Can Preferential Liberalization of Services Reduce Welfare: The Case of Tanzania," The World Bank, draft mimeo.

- Kang, Joog-Soon (2000), "Price Impact of Restrictiveness on Maritime Transportation Services," in Findlay, Christopher and Tony Warren (eds), *Impediments to Trade in Services: Measurement and Policy Implications*, (London: Routledge).
- Kimura, Fukunari, Mitsuyo Ando and Takamune Fujii (2004a), "Estimating the Ad Valorem Equivalent of Barriers to Foreign Direct Investment in the Telecommunications Services Sectors in Tanzania ." Available at <http://www.worldbank.org/trade/russia-wto>.
- Kiptui, Moses (2007), "Financial Services in Kenya," paper presented at the Trade in Services Workshop in Nairobi, Kenya, sponsored by the Ministry of Industry and Trade of Kenya and International Lawyers and Economists against Poverty, Nairobi, March 26, 27.
- Kiringai, Jane , James Thurlow and Bernadette Wanjala (2006), "A 2003 Social Accounting Matrix (SAM) For Kenya," Kenya Institute for Public Policy Research and Analysis (KIPPRA) and International Food Policy Research Institute (IFPRI), August.
- Konan, Denise Eby and Keith E. Maskus (2006), "Quantifying the impact of services liberalization in a developing country," *Journal of Development Economics*, Vol. 81, 142-162.
- Levy, Santiago & van Wijnbergen, Sweder (1995), "Transition Problems in Economic Reform: Agriculture in the North American Free Trade Agreement," *American Economic Review*, Vol. 85(4), September, 738-54.
- Markusen, James R, Thomas Rutherford and David Tarr (2005), Trade and Direct Investment in Producer Services and the Domestic Market for Expertise," *Canadian Journal of Economics*, Vol 38 (3), 758-777.
- Marshall, J.N. (1988), *Services and Uneven Development*, London: Oxford University Press.
- Matoo, Aaditya and Carsten Fink (2003), "Regional agreements and trade services - policy issues, Volume 1," World Bank Policy and Research Working Paper Number 2852. Available at: http://www-wds.worldbank.org/external/default/WDSContentServer/TW3P/IB/2002/07/09/000094946_02062104102344/Rendered/PDF/multi0page.pdf.
- Matoo, Aaditya and Pierre Sauve (2008), "Regionalism in Services Trade," in *A Handbook of International Trade in Services*, Aaditya Mattoo, Robert M. Stern and Gianni Zanini (eds.), Oxford: Oxford University Press.
- McGuire, Greg and Michael Schuele (2000), "Restrictiveness of International Trade in Banking Services," in Findlay, Christopher and Tony Warren (eds), *Impediments to Trade in Services: Measurement and Policy Implications*, (London: Routledge).
- McKee, D.L. (1988), *Growth, Development, and the Service Economy in the Third World*, New York: Praeger Publishers.
- Mircheva, Bladislava (2007), "Ad valorem equivalence to FDI restrictiveness, Kenya" Washington D.C.: The World Bank, mimeo.

- Matano, M. Ndaro and James Njeru (2007), "Communication Services in Kenya," paper presented at the Trade in Services Workshop in Nairobi, Kenya, sponsored by the Ministry of Industry and Trade of Kenya and International Lawyers and Economists against Poverty, Nairobi, March 26, 27.
- Ng, Francis and Alexander Yeats (2005), "Kenya: Export Prospects and Problems," Africa Region Working Paper Number 90, Washington DC: World Bank.
- Nguyen-Hong, D. (2000), "Restrictions on Trade in Professional Services", Productivity Commission Staff Research Paper, Ausinfo, Canberra. Available at: <http://www.pc.gov.au/research/staffresearch/rotips>
- Ochieng, David (2007), "Transport Services in Kenya," paper presented at the Trade in Services Workshop in Nairobi, Kenya, sponsored by the Ministry of Industry and Trade of Kenya and International Lawyers and Economists against Poverty, Nairobi, March 26, 27.
- Oresi, Samuel (2007), "Railway Services in Kenya," paper presented at the Trade in Services Workshop in Nairobi, Kenya, sponsored by the Ministry of Industry and Trade of Kenya and International Lawyers and Economists against Poverty, Nairobi, March 26, 27.
- Rutherford, Thomas F. and David Tarr (2008), "Poverty Effects of Russian WTO accession: modeling "real" households with endogenous productivity effects," *Journal of International Economics*, Vol 75 (1), 131-150.
- Rutherford, Thomas F. and David Tarr (2003), "Regional Trading Arrangements for Chile: Do the Results Differ with a Dynamic Model?" *Integration and Trade*, Vol. 7, Number 18, 117-139.
- Rutherford, Thomas F. and David Tarr (2002), "Trade Liberalization and Endogenous Growth in a Small Open Economy," *Journal of International Economics*, 56 (2), March, 247-272
- Rutherford, Thomas F., Rutstrom, E.E. and Tarr, David G. (1993). "Morocco's free trade agreement with the European Community: A quantitative assessment," *Economic Modelling*, Vol. 14, No. 9, 237-269.
- Rutherford, Thomas, Rutstrom, E.E. and Tarr, David (1995), "The free trade agreement between Tunisia and the European Union," World Bank, Washington, DC Mimeo. Reprinted as Rutherford, Thomas, Rutstrom, E.E. and Tarr, David (2000) "A Free Trade Agreement Between the European Agreement and a Representative Arab Mediterranean Country: A Quantitative Assessment," in Bernard Hoekman and Jamel Zarrouk (eds.), *Catching Up with the Competition: Trade Opportunities and Challenges for Arab Countries*, Ann Arbor: University of Michigan Press.
- Smith, Alasdair, and Venables, Anthony J., "Completing the Internal Market in the European Community: Some Industry Simulations", *European Economic Review*, 32, 1988, 1501-1525.
- Tarr, David (2002), "On the Design of Tariff Policy: Arguments for and Against Uniform Tariffs," in B. Hoekman, A. Mattoo and P. English (eds.), *Development, Trade and the WTO: A Handbook*, Washington: World Bank.
- Tarr, David (2007a), "Policy Note on the Kenyan Telecommunications Sector," in World Bank (2007).
- Tarr, David (2007b), "Policy Note on the Kenyan Transportation Sector," in World Bank (2007).

- Telecommunications Management Group, Inc.(2007), “Trade in Information and Communication Services: Opportunities for East and Southern Africa,” Chapter on Kenya, Draft report to the World Bank, January 31, pp.15-39.
- United Nations Conference on Trade and Development and World Bank (1994), *Liberalizing Trade in Services: A Handbook*, New York and Geneva: United Nations.
- United Nations Conference on Trade and Development, Division on Transnational Corporations and Investment (1995 and 1996), *World Investment Report 1995 and 1996*, New York and Geneva: United Nations.
- Warren, Tony (2000), “The Impact on Output of Impediments to Trade and Investment in Telecommunications Services,” in Findlay, Christopher and Tony Warren (eds), *Impediments to Trade in Services: Measurement and Policy Implications*, (London: Routledge).
- World Bank (2007), *Kenya: Unleashing the Potential for Trade and Growth*, Report No. 37688-KE, World Bank: Washington, DC. Available at:
http://imagebank.worldbank.org/servlet/WDSCContentServer/IW3P/IB/2007/03/16/000310607_20070316095914/Rendered/PDF/376880KE.pdf

Table 1 -- List of Sectors in the Kenya Model

Business Services	Agriculture (CRTS)
Communication	Maize
Insurance	Wheat
Banking and other financial services	Rice
Professional business services	Barley
Road services	Cotton
Railway transport	Other cereals
Maritime transport	Sugarcane
Pipeline transport	Coffee
Airline transport	Tea
	Roots & tubers
IRTS Goods	Pulses & oil seeds
Beverages & tobacco	Fruits
Grain milling	Vegetables
Sugar & bakery & confectionary	Cut flowers
Petroleum	Others crops
Chemicals	Beef
Metals and machines	Dairy
Non metallic products	Poultry
	Sheep goat and lamb for slaughter
Factors of Production	Other livestock
Skilled labor	
Semi-skilled labor	Other CRTS
Unskilled labor	Fishing
Capital	Forestry
Land	Mining
	Meat & dairy
Regions	Other manufactured food
Kenya	Textile & clothing
Africa (East African Customs Union + COMESA)	Leather & footwear
EU (27)	Wood & paper
Rest of World	Printing and publishing
	Other manufactures
	Water
	Electricity
	Construction
	Trade
	Hotels
	Real estate
	Adminsitration
	Health
	Education

Note: East African Custom Union includes (besides Kenya) Burundi, Rwanda, Tanzania and Uganda. COMESA includes Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Zambia and Zimbabwe.

Table 2 -- Sectoral value-added (% , unless otherwise indicated)

	Labor			Capital	Land	GDP	
	Skilled labor	Semi-skilled labor	Unskilled labor			BKS (Billions of Kenyan Shillings)	% of total
Business Services							
Communication	3.7	19.7	13.7	62.9		30.6	3.1
Insurance	1.2	5.4	19.3	74.0		21.1	2.2
Banking and other financial services	1.2	5.4	19.3	74.0		45.7	4.7
Professional business services	23.1	4.4	14.3	58.3		94.5	9.7
Road services	9.9	34.6	5.5	50.0		42.0	4.3
Railway transport	9.9	34.6	5.5	50.0		1.2	0.1
Maritime transport	9.9	34.6	5.5	50.0		4.6	0.5
Pipeline transport	9.9	34.6	5.5	50.0		2.1	0.2
Airline transport	9.9	34.6	5.5	50.0		16.9	1.7
Dixit-Stiglitz Goods							
Beverages & tobacco		0.7	34.0	65.2		13.7	1.4
Grain milling	2.1	9.5	2.9	85.5		9.6	1.0
Sugar & bakery & confectionary	7.9	36.8	11.7	43.6		4.4	0.5
Petroleum		0.4	1.3	98.4		3.9	0.4
Chemicals	16.4	5.4	29.7	48.5		7.1	0.7
Metals and machines	2.8	55.0	2.9	39.2		8.2	0.8
Non metallic products	0.5	9.8		89.7		23.1	2.4
Agriculture							
Maize	10.7	48.0	0.2	10.7	30.4	28.9	3.0
Wheat	0.7	25.0		20.6	53.7	0.4	0.0
Rice	24.8	21.2		22.6	31.3	1.1	0.1
Barley	1.1	24.9		20.6	53.4	0.7	0.1
Cotton	17.4	26.3	0.1	12.7	43.5	0.3	0.0
Other cereals	8.6	24.6	0.2	23.5	43.2	0.1	0.0
Sugarcane	7.6	37.6	0.3	11.5	43.1	1.8	0.2
Coffee	14.6	30.1	0.2	12.2	42.8	5.6	0.6
Tea	13.9	45.3	0.2	10.6	30.0	35.0	3.6
Roots & tubers	11.6	38.3	0.3	31.9	18.0	10.0	1.0
Pulses & oil seeds	12.0	38.0	0.5	11.9	37.7	19.0	1.9
Fruits	15.3	34.0	0.2	10.6	39.9	13.5	1.4
Vegetables	14.7	38.7	0.3	29.8	16.5	22.0	2.2
Cut flowers	35.2	19.7	0.1	10.3	34.7	11.7	1.2
Others crops	15.3	36.5	0.6	27.3	20.3	7.3	0.7
Beef	24.8	36.2	0.5	38.5		13.9	1.4
Dairy	26.1	35.7	0.2	38.1		23.6	2.4
Poultry	15.3	43.4	0.8	40.5		15.2	1.6
Sheep goat and lamb for slaughter	28.2	36.9	0.2	34.6		5.1	0.5
Other livestock	6.5	35.4	0.2	58.0		3.8	0.4
Other CRTS							
Fishing	3.7	7.4		88.8		3.9	0.4

Table 2 -- Sectoral value-added (% , unless otherwise indicated) continue

Forestry	3.1	23.2		73.7	7.0	0.7
Mining	16.4	30.9		52.7	3.2	0.3
Meat & dairy	3.2	27.6	0.0	69.2	11.9	1.2
Other manufactured food	8.3	36.1	0.5	55.1	0.9	0.1
Printing and publishing		44.8		55.2	5.7	0.6
Textile & clothing	57.0	9.3	0.6	33.1	5.4	0.6
Leather & footwear	13.9	2.3		83.9	5.2	0.5
Wood & paper	4.4	7.1	27.1	61.4	2.9	0.3
Other manufactures	3.3	63.9	0.6	32.3	29.8	3.0
Water		28.8	10.9	60.3	13.1	1.3
Electricity	0.7	25.4	1.5	72.3	12.9	1.3
Construction	1.5	14.9	2.5	81.1	51.8	5.3
Trade	16.6	5.6	7.0	70.8	63.6	6.5
Hotels	51.1	5.0	0.9	43.1	9.8	1.0
Real estate	0.3	29.8	13.0	57.0	56.2	5.8
Adminsitration	1.1	12.1	8.0	78.8	49.3	5.1
Health	1.6	2.6	92.5	3.2	21.2	2.2
Education	0.8	2.9	66.4	30.0	74.9	7.7

Table 3 -- Trade Flows

	Imports			Exports		
	BKS	% of total	% of supply	BKS	% of total	% of output
Business Services						
Communication				1.9	0.8	4.1
Insurance	2.4	0.7	7.5	0.4	0.2	1.5
Banking and other financial services	5.1	1.5	7.6	0.9	0.4	1.5
Professional business services						
Road services	29.9	9.0	30.7	20.3	8.3	23.1
Railway transport	1.0	0.3	29.7			
Maritime transport	3.7	1.1	29.8	2.6	1.1	23.1
Pipeline transport	1.7	0.5	29.7	1.2	0.5	23.1
Airline transport	12.9	3.9	30.1	9.0	3.7	23.1
Dixit-Stiglitz Goods						
Beverages & tobacco	1.4	0.4	5.1	12.1	4.9	30.4
Grain milling	0.7	0.2	2.1			
Sugar & bakery & confectionary	2.9	0.9	14.6	2.0	0.8	10.8
Petroleum	60.0	18.0	56.8	14.7	6.0	49.0
Chemicals	50.4	15.1	67.2	12.9	5.2	71.2
Metals and machines	48.0	14.4	69.4	5.0	2.0	55.8
Non metallic products	2.9	0.9	8.7	3.8	1.5	11.1
Agriculture						
Maize	0.7	0.2	2.0	0.3	0.1	0.6
Wheat	10.9	3.3	96.1	0.1	0.0	14.6
Rice	3.9	1.2	53.7			
Barley				0.1	0.0	11.0
Cotton				0.0	0.0	7.4
Other cereals				0.0	0.0	41.2
Sugarcane	1.5	0.4	42.5	1.5	0.6	33.7
Coffee				11.7	4.8	86.6
Tea	0.4	0.1	9.0	47.1	19.1	91.5
Roots & tubers						
Pulses & oil seeds	0.5	0.1	3.4	8.1	3.3	38.3
Fruits				2.0	0.8	18.2
Vegetables	0.5	0.1	2.7	7.9	3.2	31.0
Cut flowers				21.3	8.7	98.4
Others crops	0.7	0.2	6.0	4.5	1.8	29.9
Beef						
Dairy						
Poultry						
Sheep goat and lamb for slaughter						
Other livestock						
Other CRTS						
Fishing						
Forestry						
Mining	0.4	0.1	31.5	6.1	2.5	95.2
Meat & dairy	1.0	0.3	2.9	12.8	5.2	25.7
Other manufactured food	22.9	6.8	76.4	2.8	1.2	69.6
Printing and publishing	11.1	3.3	34.9			
Textile & clothing	9.4	2.8	43.6	4.4	1.8	31.2
Leather & footwear	1.6	0.5	9.9	3.5	1.4	20.4
Wood & paper	2.9	0.9	43.4	8.4	3.4	88.9
Other manufactures	35.4	10.6	43.9	14.7	6.0	22.2
Water						
Electricity						
Construction						
Trade						
Hotels						
Real estate	7.4	2.2	10.1	1.5	0.6	2.3
Administration						
Health						
Education						

Table 4 -- Benchmark Distortions (%)

			Regulatory barriers	
	Tariff	Sales Tax	All firms	Foreign firms
Business Services				
Communication			6.0	4.0
Insurance		0.6	13.0	26.0
Banking and other financial services		0.6	17.0	
Professional business services			3.7	11.9
Road services			15.0	30.0
Railway transport			25.0	
Maritime transport			57.0	40.0
Pipeline transport				
Airline transport			2.0	2.0
Dixit-Stiglitz Goods				
Beverages & tobacco	30.4	44.0		
Grain milling	25.8	9.4		
Sugar & bakery & confectionary	23.5	19.5		
Petroleum	10.4	22.4		
Chemicals	8.8	4.8		
Metals and machines	9.5	5.2		
Non metallic products	19.3	0.7		
Agriculture				
Maize	29.6			
Wheat	11.0			
Rice	27.6			
Barley	9.9			
Cotton	12.5	12.5		
Other cereals	9.9			
Sugarcane	64.2	19.4		
Coffee	19.7			
Tea	19.7	5.1		
Roots & tubers				
Pulses & oil seeds	6.7	0.0		
Fruits	19.5			
Vegetables	19.7	0.1		
Cut flowers	19.7			
Others crops	2.7	3.4		
Beef	19.7			
Dairy	28.9			
Poultry	19.7			
Sheep goat and lamb for slaughter				
Other livestock	19.7			
Other CRTS				
Fishing	19.7			
Forestry				
Mining	1.2	4.1		
Meat & dairy	27.6	15.5		
Other manufactured food	15.8	5.5		
Printing and publishing		12.1		
Textile & clothing	14.4	8.5		
Leather & footwear	13.8	14.5		
Wood & paper	9.2	5.9		
Other manufactures	17.2	3.0		
Water				
Electricity				
Construction				
Trade		1.9		
Hotels		13.9		
Real estate				
Adminsitration				
Health				
Education				

Source: Authors' estimates. See Balistreri, Rutherford, and Tarr (2009) for details.

Table 5 -- Trade Flows by Trading Partner (%)

	Imports			Exports		
	European Union	Africa	Rest of the World	European Union	Africa	Rest of the World
Business Services						
Communication				66	0	34
Insurance	23	0	77	23	0	77
Banking and other financial services	75	1	24	75	1	24
Professional business services						
Road services	10	70	20	10	70	20
Railway transport	0	0	100			
Maritime transport	45	27	27	45	27	27
Pipeline transport	0	41	59	0	41	59
Airline transport	43	14	43	43	14	43
Dixit-Stiglitz Goods						
Beverages & tobacco	23	58	20	7	57	37
Grain milling	13	32	55			
Sugar & bakery & confectionary	20	15	65	3	73	24
Petroleum	3	2	94	0	58	41
Chemicals	28	6	66	0	69	30
Metals and machines	27	2	70	3	78	19
Non metallic products	24	4	72	5	86	9
Agriculture						
Maize	0	91	9	0	27	73
Wheat	3	0	97	0	28	72
Rice	0	16	84			
Barley				0	100	0
Cotton				12	2	86
Other cereals				1	64	35
Sugarcane	4	65	31	0	98	2
Coffee				59	1	40
Tea	0	1	99	19	24	57
Roots & tubers						
Pulses & oil seeds	1	76	24	60	2	38
Fruits				76	6	18
Vegetables	11	43	46	89	2	9
Cut flowers				81	6	13
Others crops	14	58	28	15	53	32
Beef						
Dairy						
Poultry						
Sheep goat and lamb for slaughter						
Other livestock						
Other CRTS						
Fishing						
Forestry						
Mining	5	5	90	28	43	29
Meat & dairy	12	17	71	1	74	26
Other manufactured food	7	16	77	34	56	10
Printing and publishing	35	19	45			
Textile & clothing	3	7	89	1	18	80
Leather & footwear	3	1	96	18	48	35
Wood & paper	34	16	50	4	87	10
Other manufactures	36	2	61	14	70	17
Water						
Electricity						
Construction						
Trade						
Hotels						
Real estate	33	33	33	33	33	33
Adminsitration						
Health						
Education						

Source: Authors' estimates.

Table 6A -- Market Shares in Sectors with FDI (%)

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	26	49	0	25
Insurance	85	4	0	11
Banking and other financial services	62	29	0	9
Professional business services	94	2	2	2
Road services	80	2	14	4
Railway transport	0	0	0	100
Maritime transport	45	25	15	15
Pipeline transport	70	0	13	18
Airline transport	30	30	10	30

Source: Authors' estimates. See appendix for details.

Table 6B: Estimates of elasticity of firms with respect to price for Kenya by sector and by Kenyan trading partner region					
	R&D intensity				
	R&D expenditures divided by sales (times 1000) for the US*	Elasticity Estimates			
		Africa	EU	ROW	
SERVICES					
telecommunications	52-high	2.5	13.4	20	
banking	4-low	3.3	3.3	10	
insurance	4-low	3.3	3.3	10	
professional services	116-high	2.5	13.4	20	
air transport**	medium	1.9	10	15	
road transport	low	3.3	3.3	10	
rail transport**	medium	1.9	10	15	
water transport**	medium	1.9	10	15	
MANUFACTURING					
beverages and tobacco	14-low	3.3	3.3	10	
grain milling***	7-low	3.3	3.3	10	
sugar&bakery&confectioners***	7-low	3.3	3.3	10	
petroleum	2-low	3.3	3.3	10	
chemicals	34-medium	1.9	10	15	
metals and machines***	33-medium	1.9	10	15	
non-metallic products***	0-17-low	3.3	3.3	10	
*Based on average R&D expenditures for the years 2004 and 2005. The average for all US industries was 36.					
**We evaluate transportation as a medium R&D sector since three sectors dominate R&D expenditures of US multinationals operating abroad. These are transportation, chemicals and computers and electronics. Moreover, about two-thirds of all R&D expenditures of foreign multinationals operating in the US was performed in the same three sectors. See "U.S. and International Research and Development: Funds and Technology Linkages," at http://www.nsf.gov/statistics/seind04/c4/c4s5.htm .					
***Food is the proxy for grain milling and sugar, bakery and confectioners; machinery is used for metals and machines; for non-metallic products, we used plastics, rubber, mineral and wood products.					
Development: 2005, Data Tables . Available at: http://www.nsf.gov/statistics/nsf10319/content.cfm?pub_id=3750&id=3 . See appendix E for details of the calculations.					

Table 7: Summary of Results (results are percentage change from initial equilibrium, unless otherwise indicated)
No initial rent capture case

Scenario definition	Benchmark	EU FTA	EU Discriminatory Services	EU Tariffs	Africa FTA	EU-Africa FTA	Unilateral	Unilateral Discriminatory Services	Unilateral Tariffs	Unilateral & Domestic
50% reduction of discriminatory barriers on EU services firms	No	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes
50% reduction of discriminatory barriers on African services firm	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes
50% reduction of discriminatory barriers on ROW services firms	No	No	No	No	No	No	Yes	Yes	No	Yes
50% reduction of regulatory barriers for all services firms	No	No	No	No	No	No	No	No	No	Yes
Removal of tariffs on EU sourced goods	No	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes
Removal of tariffs on ROW sourced goods	No	No	No	No	No	No	Yes	No	Yes	Yes
Aggregate welfare										
Welfare (EV as % of consumption)		0.7	0.5	0.2	0.3	1.0	3.6	1.5	2.0	10.3
Welfare (EV as % of GDP)		0.6	0.4	0.1	0.2	0.8	3.0	1.3	1.7	8.6
Government budget										
Tariff revenue (% of GDP)	3.6	2.1	2.9	2.1	2.9	2.1		2.9		
Tariff revenue		-29.0	-0.1	-28.9	-0.1	-29.1	-100.0	-0.3	-100.0	-100.0
Aggregate trade										
Real exchange rate		0.9	0.3	0.6	0.2	1.2	4.0	0.9	3.1	5.8
Aggregate exports		3.2	0.1	3.1	0.3	3.5	12.6	0.5	11.9	15.4
Factor Earnings										
Skilled labor		2.2	0.7	1.5	0.5	2.7	9.0	2.2	6.5	15.3
Semi-skilled labor		1.1	0.5	0.6	0.3	1.4	5.6	1.5	4.1	10.3
Unskilled labor		1.5	0.6	0.9	0.3	1.9	7.4	1.9	5.3	14.3
Capital		1.5	0.5	0.9	0.3	1.8	7.0	1.7	5.1	12.4
Land		2.6	0.4	2.2	0.5	3.0	7.7	1.4	6.1	10.0
Factor adjustments										
Skilled labor		0.5	0.3	0.3	0.2	0.7	2.1	0.9	1.3	4.2
Semi-skilled labor		0.7	0.2	0.7	0.1	0.8	2.5	0.6	1.9	4.5
Unskilled labor		0.2	0.1	0.1	0.0	0.2	0.7	0.2	0.5	1.3
Capital		0.3	0.1	0.3	0.0	0.3	1.3	0.3	1.2	2.2
Land		1.0	0.5	0.7	0.4	1.4	3.7	1.4	2.2	7.2

Source: Authors' estimates.

Table 8: Summary of Results (results are percentage change from initial equilibrium, unless otherwise indicated)
Initial Rent Capture Case

Scenario definition	Benchmark	EU FTA	EU Discriminatory Services	EU Tariffs	Africa FTA	EU-Africa FTA	Unilateral	Unilateral Discriminatory Services	Unilateral Tariffs	Unilateral & Domestic
50% reduction of discriminatory barriers on EU services firms	No	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes
50% reduction of discriminatory barriers on African services firm	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes
50% reduction of discriminatory barriers on ROW services firms	No	No	No	No	No	No	Yes	Yes	No	Yes
50% reduction of regulatory barriers for all services firms	No	No	No	No	No	No	No	No	No	Yes
Removal of tariffs on EU sourced goods	No	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes
Removal of tariffs on ROW sourced goods	No	No	No	No	No	No	Yes	No	Yes	Yes
Aggregate welfare										
Welfare (EV as % of consumption)		0.5	0.3	0.2	0.1	0.5	2.9	0.9	2.0	7.0
Welfare (EV as % of GDP)		0.4	0.3	0.1	0.0	0.5	2.5	0.7	1.7	5.9
Government budget										
Tariff revenue (% of GDP)	3.6	2.1	2.9	2.1	2.9	2.1		2.9		
Tariff revenue		-29.0	-0.1	-28.9	-0.1	-29.1	-100.0	-0.4	-100.0	-100.0
Aggregate trade										
Real exchange rate		0.9	0.3	0.6	0.2	1.1	4.0	0.9	3.1	5.5
Aggregate exports		3.2	0.1	3.1	0.2	3.4	12.4	0.4	11.9	14.3
Factor Earnings										
Skilled labor		2.2	0.7	1.5	0.5	2.7	8.9	2.2	6.5	14.7
Semi-skilled labor		1.1	0.5	0.6	0.3	1.4	5.6	1.5	4.1	10.0
Unskilled labor		1.5	0.6	0.9	0.3	1.8	7.4	1.9	5.3	14.6
Capital		1.4	0.5	0.9	0.3	1.7	6.9	1.6	5.1	12.2
Land		2.5	0.3	2.2	0.4	2.9	7.5	1.1	6.1	8.5
Factor adjustments										
Skilled labor		0.6	0.4	0.3	0.3	0.9	2.3	1.1	1.3	5.0
Semi-skilled labor		0.8	0.3	0.7	0.2	0.9	2.5	0.8	1.9	4.9
Unskilled labor		0.2	0.1	0.1	0.1	0.3	0.8	0.4	0.5	2.0
Capital		0.3	0.1	0.3	0.1	0.4	1.4	0.4	1.2	2.7
Land		1.0	0.4	0.7	0.4	1.4	3.7	1.5	2.2	7.2

Source: Authors' estimates.

Table 9: Output and Employment Impacts from Liberalisation (% change from benchmark)

No initial rent capture case

	Unilateral FTA		EU-Africa FTA		Africa FTA		EU FTA	
	Output	Labor income	Output	Labor income	Output	Labor income	Output	Labor income
Business Services								
Communication	3.0	8.3	1.1	2.3	0.2	0.3	0.9	2.0
Insurance	4.1	9.8	0.9	2.0	0.2	0.4	0.7	1.6
Banking and other financial services	2.4	7.7	0.9	2.1	0.2	0.4	0.7	1.7
Professional business services	4.1	10.5	1.5	3.1	0.2	0.4	1.3	2.6
Road services	6.5	9.4	2.8	3.0	0.4	0.5	2.3	2.4
Railway transport	12.6	14.3	6.1	5.7	1.8	1.4	4.2	4.2
Maritime transport	14.3	16.8	8.2	8.2	-0.2	-0.6	8.2	8.7
Pipeline transport	5.5	7.0	2.7	2.3	0.8	0.4	1.9	1.9
Airline transport	6.6	8.4	3.2	2.8	0.9	0.4	2.3	2.4
Dixit-Stiglitz Goods								
Beverages & tobacco	6.2	12.1	0.6	1.9	0.1	0.3	0.5	1.6
Grain milling	2.7	10.0	0.5	2.4	0.1	0.4	0.4	1.9
Sugar & bakery & confectionary	-2.4	4.0	0.4	2.1	0.1	0.4	0.3	1.7
Petroleum	0.7	3.5	3.4	4.0	0.2	0.2	3.2	3.7
Chemicals	1.5	7.3	-0.4	1.0	0.0	0.3	-0.4	0.7
Metals and machines	-8.4	-3.3	-3.7	-2.5	0.0	0.3	-3.7	-2.7
Non metallic products	-14.2	-9.7	-1.0	0.6	0.0	0.3	-1.0	0.3
Agriculture								
Maize	1.7	7.1	0.6	2.1	0.1	0.3	0.6	1.8
Wheat	-27.7	-24.9	-2.7	-0.9	-0.2	0.1	-2.4	-1.0
Rice	-29.8	-27.0	0.6	2.0	0.1	0.3	0.5	1.7
Barley	3.3	10.0	0.1	2.2	0.0	0.4	0.1	1.8
Cotton	2.5	7.6	0.5	1.9	0.1	0.3	0.4	1.6
Other cereals	-2.1	3.9	-0.9	1.1	-0.2	0.1	-0.6	0.9
Sugarcane	-31.0	-30.2	-3.2	-3.4	2.3	1.9	-5.5	-5.4
Coffee	52.4	60.9	15.5	17.4	0.4	0.7	15.1	16.8
Tea	-7.3	-2.1	-1.6	0.0	-1.2	-1.0	-0.3	1.1
Roots & tubers	0.6	4.9	0.3	1.4	0.1	0.3	0.2	1.1
Pulses & oil seeds	0.3	5.7	0.1	1.7	0.0	0.3	0.1	1.4
Fruits	-0.4	5.0	-0.1	1.4	0.1	0.3	-0.2	1.1
Vegetables	-0.7	4.8	0.3	1.8	0.1	0.3	0.2	1.5
Cut flowers	21.1	27.1	11.2	12.7	4.8	4.9	6.1	7.4
Others crops	1.0	5.6	1.2	2.5	0.1	0.3	1.2	2.2
Beef	2.2	9.3	0.6	2.5	0.0	0.4	0.6	2.1
Dairy	0.4	7.1	0.1	1.9	0.0	0.3	0.1	1.5
Poultry	0.6	7.1	0.1	1.8	0.0	0.3	0.1	1.5
Sheep goat and lamb for slaughter	0.9	7.9	0.1	2.0	0.0	0.4	0.1	1.7
Other livestock	-0.5	6.1	0.0	1.7	0.0	0.3	-0.1	1.3
Other CRTS								
Fishing	0.3	7.3	-0.1	1.7	0.0	0.4	-0.1	1.3
Forestry	0.1	6.8	0.0	1.8	0.0	0.4	0.0	1.4
Mining	81.3	96.4	9.0	10.8	0.8	1.0	8.1	9.7
Meat & dairy	7.1	13.6	0.9	2.4	0.1	0.3	0.8	2.0
Other manufactured food	49.6	63.3	8.1	10.5	0.7	1.1	7.4	9.3
Printing and publishing	6.2	12.6	0.8	2.1	0.1	0.3	0.7	1.8
Textile & clothing	-4.4	3.1	-0.1	2.2	-0.1	0.4	-0.1	1.8
Leather & footwear	4.7	12.8	0.4	2.3	0.0	0.4	0.4	2.0
Wood & paper	4.3	11.6	-0.8	0.8	0.1	0.5	-0.9	0.4
Other manufactures	-12.1	-7.3	-6.2	-5.1	0.0	0.3	-6.3	-5.4
Water	-0.5	5.9	0.1	1.8	0.0	0.3	0.1	1.4
Electricity	0.5	6.7	0.4	1.9	0.1	0.4	0.2	1.5
Construction	0.0	6.0	0.0	1.5	0.0	0.3	0.0	1.2
Trade	3.4	7.6	1.1	2.0	0.1	0.2	1.0	1.7
Hotels	0.4	5.6	0.0	1.3	0.0	0.3	0.0	1.1
Real estate	-2.3	3.5	-0.5	1.0	0.0	0.3	-0.5	0.7
Administration	0.0	6.4	0.0	1.6	0.0	0.3	0.0	1.3
Health	-0.3	7.0	-0.2	1.6	0.0	0.3	-0.2	1.3
Education	-0.3	6.7	-0.1	1.7	0.0	0.3	-0.1	1.4

Source: Authors' estimates.

Table 10: Impacts on Imports from Unilateral Liberalisation (% change from benchmark)
No initial rent capture case

	European Union	Africa	Rest of the World
Business Services			
Communication			
Insurance	-1.0		5.5
Banking and other financial services	3.4	3.4	3.9
Professional business services			
Road services	-6.3	-6.3	-4.2
Railway transport			-3.0
Maritime transport	-20.9	-25.2	-19.1
Pipeline transport		-0.9	-0.5
Airline transport	-2.6	-3.2	-2.4
Dixit-Stiglitz Goods			
Beverages & tobacco	67.0	-6.6	148.7
Grain milling	59.6	-13.9	218.3
Sugar & bakery & confectionary	43.7	-20.8	118.6
Petroleum	2.8	-25.4	6.5
Chemicals	5.1	-14.2	6.0
Metals and machines	6.0	-19.8	9.1
Non metallic products	37.4	-24.2	187.9
Agriculture			
Maize	173.2	-3.1	173.2
Wheat	4.2	-31.4	4.2
Rice	65.3	-37.6	65.3
Barley			
Cotton			
Other cereals			
Sugarcane	216.2	-56.5	216.2
Coffee			
Tea	58.3	-22.9	58.3
Roots & tubers			
Pulses & oil seeds	31.3	1.4	31.3
Fruits			
Vegetables	98.7	-3.2	98.7
Cut flowers			
Others crops	11.6	0.4	11.6
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	-26.0	-29.4	-26.0
Meat & dairy	107.8	-21.6	107.8
Other manufactured food	16.5	-35.3	16.5
Printing and publishing	-3.4	-3.4	-3.4
Textile & clothing	29.2	-24.5	29.2
Leather & footwear	44.1	-14.1	44.1
Wood & paper	17.9	-17.2	17.9
Other manufactures	26.6	-32.8	26.6
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	4.3	4.3	4.3
Administration			
Health			
Education			

Source: Authors' estimates.

Table 11: Impacts on Exports from Unilateral Liberalisation (% change from benchmark)
No initial rent capture case

	European Union	Africa	Rest of the World
Business Services			
Communication	0.2		0.2
Insurance	-6.6		-6.6
Banking and other financial services	-1.6	-1.6	-1.6
Professional business services			
Road services	5.1	5.1	5.1
Railway transport			23.8
Maritime transport	3.4	3.4	3.4
Pipeline transport		6.8	6.8
Airline transport	6.4	6.4	6.4
Dixit-Stiglitz Goods			
Beverages & tobacco	13.8	13.8	13.8
Grain milling			
Sugar & bakery & confectionary	15.0	15.0	15.0
Petroleum	16.2	16.2	16.2
Chemicals	7.5	7.5	7.5
Metals and machines	52.8	52.8	52.8
Non metallic products	20.1	20.1	20.1
Agriculture			
Maize	6.0	6.0	6.0
Wheat		-25.3	-25.3
Rice			
Barley		-3.5	
Cotton	1.9	1.9	1.9
Other cereals	-5.1	-5.1	-5.1
Sugarcane	-15.5	-15.5	-15.5
Coffee	55.7	55.7	55.7
Tea	-7.0	-7.0	-7.0
Roots & tubers			
Pulses & oil seeds	-0.7	-0.7	-0.7
Fruits	-3.3	-3.3	-3.3
Vegetables	-0.8	-0.8	-0.8
Cut flowers	21.4	21.4	21.4
Others crops	1.3	1.3	1.3
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	85.2	85.2	85.2
Meat & dairy	23.5	23.5	23.5
Other manufactured food	77.4	77.4	77.4
Printing and publishing			
Textile & clothing	6.6	6.6	6.6
Leather & footwear	18.1	18.1	18.1
Wood & paper	5.5	5.5	5.5
Other manufactures	3.6	3.6	3.6
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	-8.2	-8.2	-8.2
Administration			
Health			
Education			

Source: Authors' estimates.

Table 12: Impacts on Number of Firms from Unilateral Liberalisation (% change from benchmark)
No initial rent capture case

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	-1.8	5.3		6.2
Insurance	-6.3	33.4		91.4
Banking and other financial services	1.4	1.7	1.7	3.5
Professional business services	1.1	50.7	13.7	61.1
Road services	-0.3	39.8	39.7	128.3
Railway transport				7.5
Maritime transport	-9.0	86.4	16.7	115.9
Pipeline transport	3.9		3.0	12.2
Airline transport	3.3	9.1	2.7	11.1
Dixit-Stiglitz Goods				
Beverages & tobacco	5.5	50.6	-5.4	116.4
Grain milling	2.2	45.5	-11.5	169.9
Sugar & bakery & confectionary	-2.3	33.4	-17.1	92.2
Petroleum	0.6	2.2	-20.6	5.1
Chemicals	1.4	3.9	-11.3	4.7
Metals and machines	-7.3	4.6	-15.9	7.0
Non metallic products	-10.5	28.9	-20.1	144.9

Source: Authors' estimates.

Table 13: Impacts on Imports from combined EU and Africa FTAs
No initial rent capture case (% change from benchmark)

	European Union	Africa	Rest of the World
Business Services			
Communication			
Insurance	3.4		-0.4
Banking and other financial services	0.6	0.6	0.8
Professional business services			
Road services	-3.5	-3.5	-4.3
Railway transport			-1.9
Maritime transport	-11.8	-18.1	-20.7
Pipeline transport		-0.8	-0.7
Airline transport	-1.4	-1.9	-1.8
Dixit-Stiglitz Goods			
Beverages & tobacco	75.3	-1.5	-2.5
Grain milling	79.3	-1.7	-3.4
Sugar & bakery & confectionary	72.5	-3.6	-7.0
Petroleum	36.0	-0.8	-1.7
Chemicals	43.7	-4.4	-14.3
Metals and machines	129.4	-8.5	-43.3
Non metallic products	72.1	-2.6	-6.8
Agriculture			
Maize	178.7	-1.1	-1.1
Wheat	51.1	-0.6	-0.6
Rice	164.2	-0.3	-0.3
Barley			
Cotton			
Other cereals			
Sugarcane	521.0	-14.6	-14.6
Coffee			
Tea	104.5	-0.4	-0.4
Roots & tubers			
Pulses & oil seeds	29.9	0.3	0.3
Fruits			
Vegetables	102.5	-1.4	-1.4
Cut flowers			
Others crops	11.5	0.4	0.4
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	1.5	-3.1	-3.1
Meat & dairy	153.6	-4.3	-4.3
Other manufactured food	72.7	-4.1	-4.1
Printing and publishing	-0.6	-0.6	-0.6
Textile & clothing	69.5	-0.9	-0.9
Leather & footwear	67.6	0.0	0.0
Wood & paper	32.1	-7.2	-7.2
Other manufactures	59.8	-15.1	-15.1
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	0.5	0.5	0.5
Administration			
Health			
Education			

Source: Authors' estimates.

Table 14: Impacts on Exports from Combined EU-Africa FTA
No initial rent capture case (% change from benchmark)

	European Union	Africa	Rest of the World
Business Services			
Communication	0.2		0.2
Insurance	-0.2		-0.2
Banking and other financial services	0.4	0.4	0.4
Professional business services			
Road services	2.6	2.6	2.6
Railway transport			11.8
Maritime transport	1.7	1.7	1.7
Pipeline transport		3.8	3.8
Airline transport	3.6	3.6	3.6
Dixit-Stiglitz Goods			
Beverages & tobacco	1.9	1.9	1.9
Grain milling			
Sugar & bakery & confectionary	3.6	3.6	3.6
Petroleum	4.6	4.6	4.6
Chemicals	1.2	1.2	1.2
Metals and machines	26.0	26.0	26.0
Non metallic products	2.6	2.6	2.6
Agriculture			
Maize	2.4	2.4	2.4
Wheat		-4.5	-4.5
Rice			
Barley		-2.4	
Cotton	0.5	0.5	0.5
Other cereals	-2.1	-2.1	-2.1
Sugarcane	2.8	2.8	2.8
Coffee	16.6	16.6	16.6
Tea	-1.7	-1.7	-1.7
Roots & tubers			
Pulses & oil seeds	-0.1	-0.1	-0.1
Fruits	-1.0	-1.0	-1.0
Vegetables	1.0	1.0	1.0
Cut flowers	11.4	11.4	11.4
Others crops	1.7	1.7	1.7
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	9.4	9.4	9.4
Meat & dairy	3.5	3.5	3.5
Other manufactured food	11.9	11.9	11.9
Printing and publishing			
Textile & clothing	0.2	0.2	0.2
Leather & footwear	0.6	0.6	0.6
Wood & paper	-0.5	-0.5	-0.5
Other manufactures	-0.2	-0.2	-0.2
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	-1.3	-1.3	-1.3
Administration			
Health			
Education			

Source: Authors' estimates.

Table 15: Impacts on Number of Firms from Combined EU-Africa FTA
No initial rent capture case **(% change from benchmark)**

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	-1.4	7.0		-5.4
Insurance	-0.3	42.2		-0.6
Banking and other financial services	0.6	0.6	0.6	1.2
Professional business services	0.2	46.4	12.8	0.6
Road services	-0.5	41.1	41.0	-4.2
Railway transport				3.6
Maritime transport	-7.0	120.3	20.3	-35.0
Pipeline transport	2.0		1.4	5.6
Airline transport	1.8	7.1	2.1	2.2
Dixit-Stiglitz Goods				
Beverages & tobacco	0.6	56.5	-1.2	-2.0
Grain milling	0.4	59.5	-1.3	-2.8
Sugar & bakery & confectionary	0.4	53.9	-2.9	-5.6
Petroleum	3.2	27.2	-0.6	-1.4
Chemicals	-0.4	33.3	-3.4	-11.1
Metals and machines	-3.2	96.9	-6.7	-33.9
Non metallic products	-0.7	53.8	-2.1	-5.5

Source: Authors' estimates.

Table 16: Impacts on Imports from African FTA
No initial rent capture case (**% change from benchmark**)

	European Union	Africa	Rest of the World
Business Services			
Communication			
Insurance	0.1		0.1
Banking and other financial services	0.1	0.1	0.2
Professional business services			
Road services	-3.0	-2.3	-3.1
Railway transport			-0.6
Maritime transport	-2.5	-1.7	-2.5
Pipeline transport		-0.3	-0.3
Airline transport	-0.4	-0.4	-0.4
Dixit-Stiglitz Goods			
Beverages & tobacco	0.0	0.0	0.1
Grain milling	0.0	0.0	0.0
Sugar & bakery & confectionary	0.0	0.0	0.1
Petroleum	0.0	0.0	0.0
Chemicals	0.1	0.0	0.1
Metals and machines	0.0	0.0	0.1
Non metallic products	0.1	0.1	0.2
Agriculture			
Maize	0.2	0.2	0.2
Wheat	0.1	0.1	0.1
Rice	0.1	0.1	0.1
Barley			
Cotton			
Other cereals			
Sugarcane	-1.1	-1.1	-1.1
Coffee			
Tea	-0.4	-0.4	-0.4
Roots & tubers			
Pulses & oil seeds	0.2	0.2	0.2
Fruits			
Vegetables	0.0	0.0	0.0
Cut flowers			
Others crops	0.2	0.2	0.2
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	-0.2	-0.2	-0.2
Meat & dairy	0.0	0.0	0.0
Other manufactured food	0.0	0.0	0.0
Printing and publishing	0.1	0.1	0.1
Textile & clothing	0.3	0.3	0.3
Leather & footwear	0.2	0.2	0.2
Wood & paper	0.9	0.9	0.9
Other manufactures	0.2	0.2	0.2
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	0.2	0.2	0.2
Administration			
Health			
Education			

Source: Authors' estimates.

Table 17: Impacts on Exports from African FTA
No initial rent capture case **(% change from benchmark)**

	European Union	Africa	Rest of the World
Business Services			
Communication	0.1		0.1
Insurance	0.1		0.1
Banking and other financial services	0.1	0.1	0.1
Professional business services			
Road services	-1.1	-1.1	-1.1
Railway transport			3.6
Maritime transport	1.3	1.3	1.3
Pipeline transport		1.2	1.2
Airline transport	1.2	1.2	1.2
Dixit-Stiglitz Goods			
Beverages & tobacco	0.2	0.2	0.2
Grain milling			
Sugar & bakery & confectionary	0.1	0.1	0.1
Petroleum	0.3	0.3	0.3
Chemicals	0.0	0.0	0.0
Metals and machines	0.0	0.0	0.0
Non metallic products	0.0	0.0	0.0
Agriculture			
Maize	0.0	0.0	0.0
Wheat		-0.5	-0.5
Rice			
Barley		-0.3	
Cotton	0.1	0.1	0.1
Other cereals	-0.5	-0.5	-0.5
Sugarcane	4.1	4.1	4.1
Coffee	0.5	0.5	0.5
Tea	-1.2	-1.2	-1.2
Roots & tubers			
Pulses & oil seeds	-0.1	-0.1	-0.1
Fruits	0.0	0.0	0.0
Vegetables	0.2	0.2	0.2
Cut flowers	4.9	4.9	4.9
Others crops	0.0	0.0	0.0
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	0.8	0.8	0.8
Meat & dairy	0.2	0.2	0.2
Other manufactured food	0.8	0.8	0.8
Printing and publishing			
Textile & clothing	-0.3	-0.3	-0.3
Leather & footwear	-0.1	-0.1	-0.1
Wood & paper	0.1	0.1	0.1
Other manufactures	-0.1	-0.1	-0.1
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	-0.1	-0.1	-0.1
Administration			
Health			
Education			

Source: Authors' estimates.

Table 18: Impacts on Number of Firms from African FTA
No initial rent capture case **(% change from benchmark)**

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	0.0	0.1		0.2
Insurance	0.1	0.1		0.2
Banking and other financial services	0.1	0.1	0.1	0.2
Professional business services	0.0	-0.1	12.6	-0.1
Road services	-2.2	-2.8	40.2	-5.5
Railway transport				1.1
Maritime transport	-0.1	-2.8	28.3	-3.4
Pipeline transport	0.6		0.4	1.6
Airline transport	0.7	0.9	1.9	1.0
Dixit-Stiglitz Goods				
Beverages & tobacco	0.1	0.0	0.0	0.0
Grain milling	0.1	0.0	0.0	0.0
Sugar & bakery & confectionary	0.1	0.0	0.0	0.1
Petroleum	0.2	0.0	0.0	0.0
Chemicals	0.0	0.1	0.0	0.1
Metals and machines	0.0	0.0	0.0	0.0
Non metallic products	0.0	0.1	0.1	0.2

Source: Authors' estimates.

Table 19: Impacts on Imports from EU FTA

No initial rent capture case

(% change from benchmark)

	European Union	Africa	Rest of the World
Business Services			
Communication			
Insurance	3.3		-0.5
Banking and other financial services	0.5	0.5	0.6
Professional business services			
Road services	-0.6	-1.3	-1.3
Railway transport			-1.2
Maritime transport	-9.6	-17.2	-18.8
Pipeline transport		-0.6	-0.4
Airline transport	-1.0	-1.4	-1.4
Dixit-Stiglitz Goods			
Beverages & tobacco	75.2	-1.6	-2.6
Grain milling	79.3	-1.7	-3.5
Sugar & bakery & confectionary	72.4	-3.7	-7.1
Petroleum	36.0	-0.8	-1.8
Chemicals	43.5	-4.4	-14.4
Metals and machines	129.3	-8.5	-43.3
Non metallic products	71.9	-2.7	-7.0
Agriculture			
Maize	178.2	-1.3	-1.3
Wheat	51.0	-0.7	-0.7
Rice	163.9	-0.4	-0.4
Barley			
Cotton			
Other cereals			
Sugarcane	527.5	-13.7	-13.7
Coffee			
Tea	105.4	0.0	0.0
Roots & tubers			
Pulses & oil seeds	29.6	0.1	0.1
Fruits			
Vegetables	102.5	-1.4	-1.4
Cut flowers			
Others crops	11.4	0.2	0.2
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	1.7	-2.9	-2.9
Meat & dairy	153.5	-4.4	-4.4
Other manufactured food	72.6	-4.1	-4.1
Printing and publishing	-0.7	-0.7	-0.7
Textile & clothing	68.9	-1.3	-1.3
Leather & footwear	67.3	-0.2	-0.2
Wood & paper	30.9	-8.1	-8.1
Other manufactures	59.5	-15.3	-15.3
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	0.3	0.3	0.3
Administration			
Health			
Education			

Source: Authors' estimates.

Table 20: Impacts on Exports from EU FTA
No initial rent capture case (% change from benchmark)

	European Union	Africa	Rest of the World
Business Services			
Communication	0.2		0.2
Insurance	-0.2		-0.2
Banking and other financial services	0.3	0.3	0.3
Professional business services			
Road services	3.6	3.6	3.6
Railway transport			7.9
Maritime transport	0.4	0.4	0.4
Pipeline transport		2.6	2.6
Airline transport	2.5	2.5	2.5
Dixit-Stiglitz Goods			
Beverages & tobacco	1.7	1.7	1.7
Grain milling			
Sugar & bakery & confectionary	3.5	3.5	3.5
Petroleum	4.4	4.4	4.4
Chemicals	1.2	1.2	1.2
Metals and machines	25.9	25.9	25.9
Non metallic products	2.6	2.6	2.6
Agriculture			
Maize	2.4	2.4	2.4
Wheat		-3.9	-3.9
Rice			
Barley		-2.1	
Cotton	0.4	0.4	0.4
Other cereals	-1.6	-1.6	-1.6
Sugarcane	-1.3	-1.3	-1.3
Coffee	16.2	16.2	16.2
Tea	-0.4	-0.4	-0.4
Roots & tubers			
Pulses & oil seeds	0.0	0.0	0.0
Fruits	-1.0	-1.0	-1.0
Vegetables	0.8	0.8	0.8
Cut flowers	6.2	6.2	6.2
Others crops	1.7	1.7	1.7
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	8.5	8.5	8.5
Meat & dairy	3.4	3.4	3.4
Other manufactured food	10.9	10.9	10.9
Printing and publishing			
Textile & clothing	0.5	0.5	0.5
Leather & footwear	0.7	0.7	0.7
Wood & paper	-0.6	-0.6	-0.6
Other manufactures	-0.1	-0.1	-0.1
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	-1.2	-1.2	-1.2
Administration			
Health			
Education			

Source: Authors' estimates.

Table 21: Impacts on Number of Firms from EU FTA
No initial rent capture case **(% change from benchmark)**

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	-1.4	6.9		-5.6
Insurance	-0.4	42.0		-0.8
Banking and other financial services	0.5	0.5	0.5	0.9
Professional business services	0.2	46.5	0.2	0.7
Road services	1.7	44.3	0.7	1.4
Railway transport				2.5
Maritime transport	-7.0	127.4	-12.2	-33.1
Pipeline transport	1.4		1.0	3.8
Airline transport	1.2	6.2	0.3	1.1
Dixit-Stiglitz Goods				
Beverages & tobacco	0.4	56.5	-1.3	-2.1
Grain milling	0.4	59.5	-1.4	-2.8
Sugar & bakery & confectionary	0.3	53.9	-3.0	-5.7
Petroleum	3.0	27.1	-0.6	-1.4
Chemicals	-0.4	33.2	-3.5	-11.2
Metals and machines	-3.2	96.8	-6.7	-33.9
Non metallic products	-0.7	53.7	-2.2	-5.6

Source: Authors' estimates.

Table 22: Sensitivity Analysis of Kenya-EU FTA						
Parameter	Parameter Value			% Welfare Change (EV)		
	Lower	Central	Upper	Lower	Central	Upper
$\sigma(q_i, q_j)$ – services sectors	1.5	3	4.5	9.99	0.67	0.50
$\sigma(q_i, q_j)$ – goods sectors	see below			1.06	0.67	0.59
$\sigma(va, bs)$	0.625	1.25	1.875	0.55	0.67	0.82
$\sigma(D, M)$	2	4	6	0.65	0.67	0.69
$\sigma(L, K)$	0.5	1	1.5	0.64	0.67	0.70
$\sigma(A_1, \dots, A_n)$	0	0	0.25	0.67	0.67	0.67
$\sigma(D, E)$	2	4	6	0.65	0.67	0.69
ε_{KEN}	Central values of all 4 sets of eta parameters are listed in table 6B			0.61	0.67	0.72
ε_{EU}				0.25	0.67	0.96
ε_{AFR}	Lower values are 0.5 central values and			0.68	0.67	0.67
ε_{ROW}	upper values are 1.5 times central values			0.90	0.67	0.55
share of rents captured	0	0	1	0.67	0.67	0.49
CRTS--share of rents captured	NA	0	1	NA	0.09	-0.06
θ_m	0.025	0.05	0.075	0.67	0.67	0.67
$\sigma(q_i, q_j)$ – goods sectors						
sugar and bakery	2.12	2.93	3.74			
beverages and tobacco	1.52	2.33	3.14			
chemicals	2.01	2.82	3.63			
metals and machines	8.345	16.69	25.035			
grain milling	2.43	3.24	4.05			
nonmetallic products	2.805	5.61	8.415			
petroleum	2.75	3.56	4.37			
Source: Authors' estimates						

Table 23: Sensitivity Analysis of Kenya-Africa FTA						
Parameter	Parameter Value			% Welfare Change (EV)		
	Lower	Central	Upper	Lower	Central	Upper
$\sigma(q_i, q_j)$ – services sectors	1.5	3	4.5	5.02	0.29	0.16
$\sigma(q_i, q_j)$ – goods sectors		see below		0.32	0.29	0.28
$\sigma(va, bs)$	0.625	1.25	1.875	0.25	0.29	0.33
$\sigma(D, M)$	2	4	6	0.28	0.29	0.29
$\sigma(L, K)$	0.5	1	1.5	0.28	0.29	0.29
$\sigma(A_1, \dots, A_n)$	0	0	0.25	0.29	0.29	0.29
$\sigma(D, E)$	2	4	6	0.28	0.29	0.29
ε_{KEN}	Central values of all 4 sets of eta parameters are listed in table 6B			0.31	0.29	0.27
ε_{EU}				0.29	0.29	0.29
ε_{AFR}	Lower values are 0.5 central values and			0.14	0.29	0.43
ε_{ROW}	upper values are 1.5 times central values			0.29	0.29	0.29
share of rents captured	0	0	1	0.29	0.29	0.05
CRTS--share of rents captured	NA	0	1	NA	0.14	-0.06
θ_m	0.025	0.05	0.075	0.29	0.29	0.29
$\sigma(q_i, q_j)$ – goods sectors						
sugar and bakery	2.12	2.93	3.74			
beverages and tobacco	1.52	2.33	3.14			
chemicals	2.01	2.82	3.63			
metals and machines	8.345	16.69	25.035			
grain milling	2.43	3.24	4.05			
nonmetallic products	2.805	5.61	8.415			
petroleum	2.75	3.56	4.37			
Source: Authors' estimates						

Table 24: Summary of Results for Professional Services --No Initial Rent Capture Case
(results are percentage change from initial equilibrium, unless otherwise indicated)

Scenario definition	Domestic & Discriminatory Services	Domestic Services	Unilateral Discriminatory Services	EU Discriminatory Services	Africa Discriminatory Services	Africa-EU Discriminatory Services	Rest of World Discriminatory Services
50% reduction of discriminatory barriers on EU services firms	Yes	No	Yes	Yes	No	Yes	No
50% reduction of discriminatory barriers on African services firm	Yes	No	Yes	No	Yes	Yes	No
50% reduction of discriminatory barriers on ROW services firms	Yes	No	Yes	No	No	No	Yes
50% reduction of regulatory barriers for all services firms	Yes	Yes	No	No	No	No	No
Aggregate welfare							
Welfare (EV as % of consumption)	0.71	0.54	0.16	0.06	0.02	0.08	0.07
Welfare (EV as % of GDP)	0.60	0.45	0.13	0.05	0.02	0.07	0.06
Government budget							
Tariff revenue (% of GDP)	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Tariff revenue	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
Aggregate trade							
Real exchange rate	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Aggregate exports	0.6	0.4	0.2	0.1	0.1	0.1	0.1
Factor Earnings							
Skilled labor	1.0	0.6	0.4	0.2	0.0	0.2	0.2
Semi-skilled labor	0.5	0.4	0.1	0.1	0.0	0.1	0.1
Unskilled labor	0.8	0.5	0.3	0.1	0.0	0.1	0.1
Capital	0.7	0.4	0.2	0.1	0.0	0.1	0.1
Land	1.2	0.8	0.4	0.1	0.1	0.2	0.2
Factor adjustments							
Skilled labor	0.5	0.3	0.2	0.1	0.0	0.1	0.1
Semi-skilled labor	0.4	0.2	0.1	0.0	0.0	0.1	0.1
Unskilled labor	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Capital	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Land	1.1	0.7	0.3	0.1	0.0	0.2	0.2

Source: Authors' estimates.

Table 25: Summary of Results for Professional Services, initial rent capture case
(results are percentage change from initial equilibrium, unless otherwise indicated)

Scenario definition	Domestic & Discriminatory Services	Domestic Services	Unilateral Discriminatory Services	EU Discriminatory Services	Africa Discriminatory Services	Africa-EU Discriminatory Services	Rest of World Discriminatory Services
50% reduction of discriminatory barriers on EU services firms	Yes	No	Yes	Yes	No	Yes	No
50% reduction of discriminatory barriers on African services firm	Yes	No	Yes	No	Yes	Yes	No
50% reduction of discriminatory barriers on ROW services firms	Yes	No	Yes	No	No	No	Yes
50% reduction of regulatory barriers for all services firms	Yes	Yes	No	No	No	No	No
Aggregate welfare							
Welfare (EV as % of consumption)	0.63	0.52	0.09	0.04	0.00	0.08	0.05
Welfare (EV as % of GDP)	0.53	0.44	0.08	0.04	0.00	0.07	0.04
Government budget							
Tariff revenue (% of GDP)	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Tariff revenue	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
Aggregate trade							
Real exchange rate	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Aggregate exports	0.6	0.4	0.2	0.1	0.0	0.1	0.1
Factor Earnings							
Skilled labor	1.0	0.6	0.4	0.2	0.0	0.2	0.2
Semi-skilled labor	0.5	0.3	0.1	0.0	0.0	0.1	0.1
Unskilled labor	0.8	0.5	0.3	0.1	0.0	0.1	0.1
Capital	0.6	0.4	0.2	0.1	0.0	0.1	0.1
Land	1.1	0.8	0.3	0.1	0.0	0.2	0.2
Factor adjustments							
Skilled labor	0.5	0.3	0.3	0.1	0.0	0.1	0.1
Semi-skilled labor	0.4	0.2	0.1	0.0	0.0	0.1	0.1
Unskilled labor	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Capital	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Land	1.1	0.7	0.3	0.1	0.0	0.2	0.1

Source: Authors' estimates.

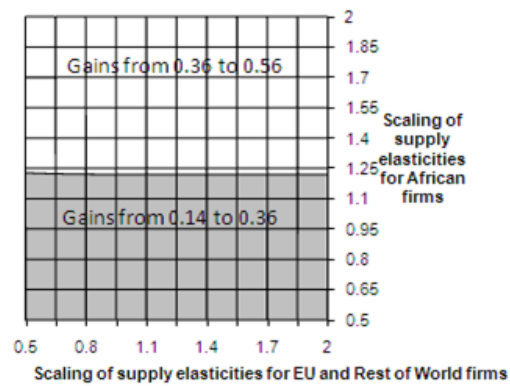
Table 26: Impacts on Number of Firms from Liberalisation of Barriers in Professional Services
No initial rent capture case % change from benchmark

	Domestic & Discriminatory Services	Domestic Services	Unilateral Discriminatory Services	EU Discriminatory Services	Africa Discriminatory Services	Africa-EU Discriminatory Services	Rest of World Discriminatory Services
Kenya	0.5	1.7	-1.1	-0.5	-0.1	-0.6	-0.6
European Union	49.2	5.1	40.2	43.3	-0.4	42.7	-1.6
Africa	13.4	1.7	11.4	-0.5	12.5	12.0	-0.6
Rest of the World	59.2	6.0	48.2	-1.6	-0.4	-2.0	51.4

Source: Authors' estimates.

Figure 1 Sensitivity Analysis of Kenyan Preferential Liberalization of Services with African Partners: Impact of Partner and Excluded Country Supply Elasticity, with and without Rent Capture

Case I: No initial rent capture by Kenya



Case II: Initial rent capture by Kenya

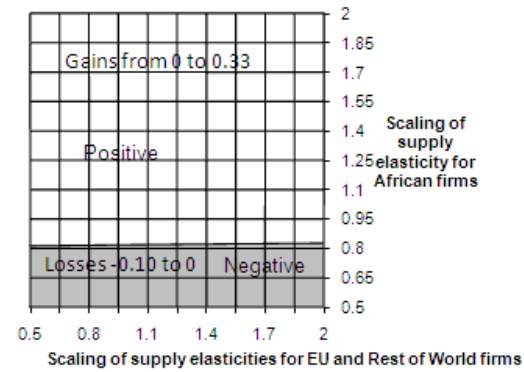
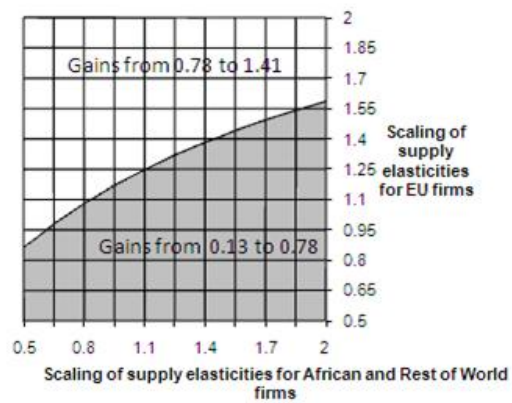
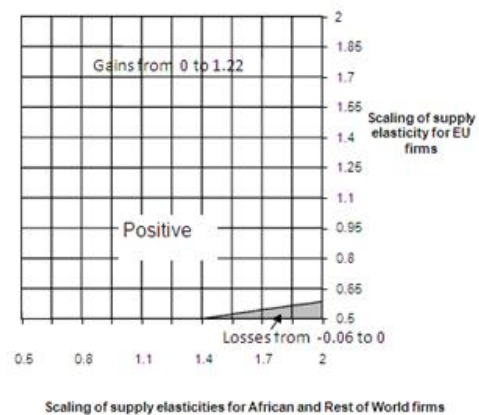


Figure 2: Sensitivity Analysis of Kenyan Preferential Liberalization of Services with the EU: Impact of Partner and Excluded Country Supply Elasticity, with and without Rent Capture

Case I: No initial rent capture by Kenya



Case II: Initial rent capture by Kenya



**Figure 3: Sample Frequency Distribution of the Welfare Results of Kenyan
Preferential Reduction of Services Barriers Against African Partners—30,000 simulations.**

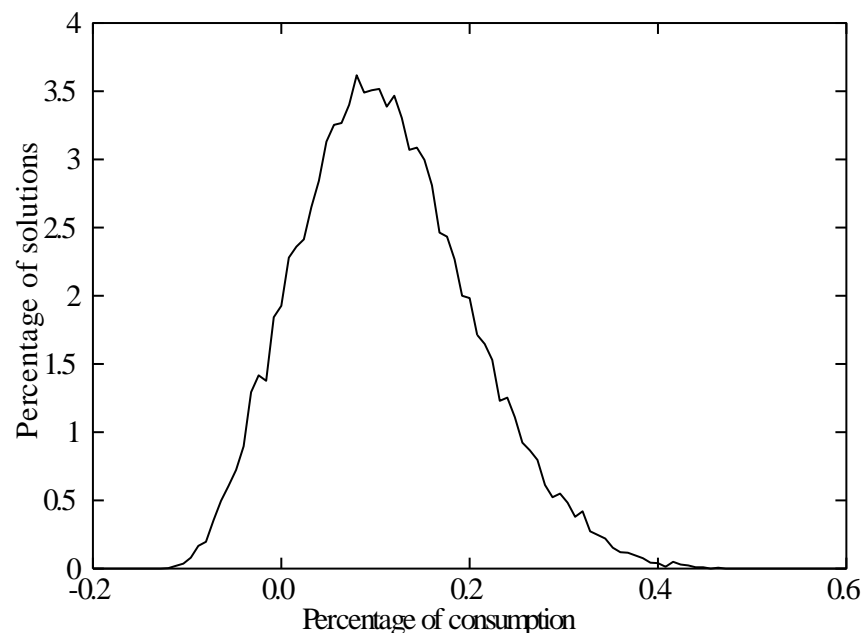
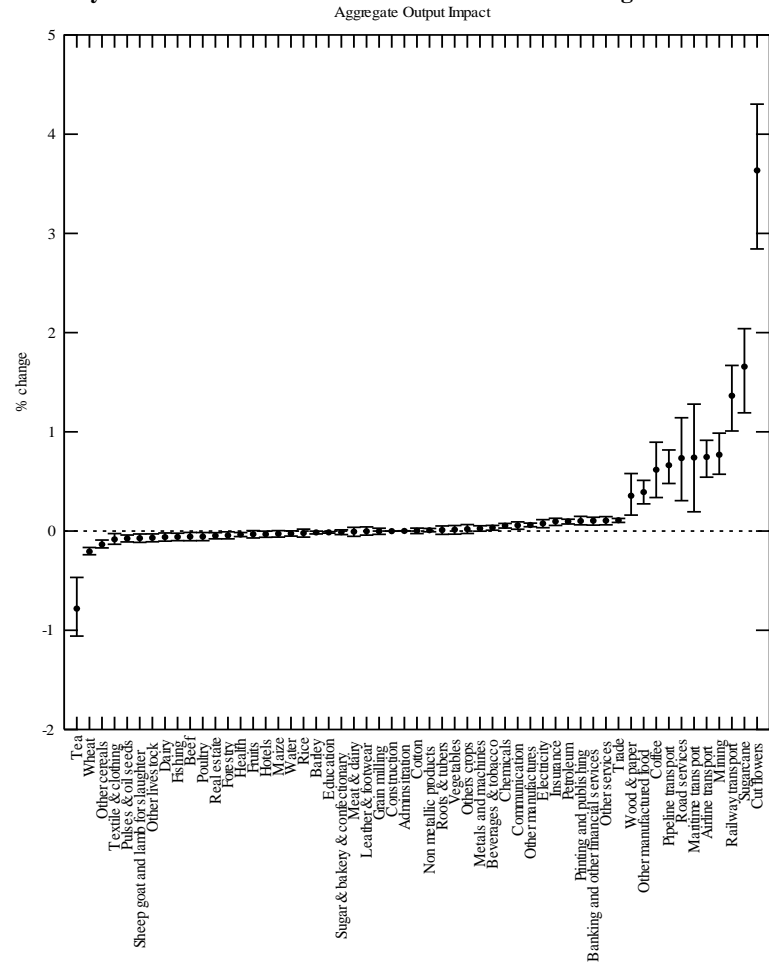
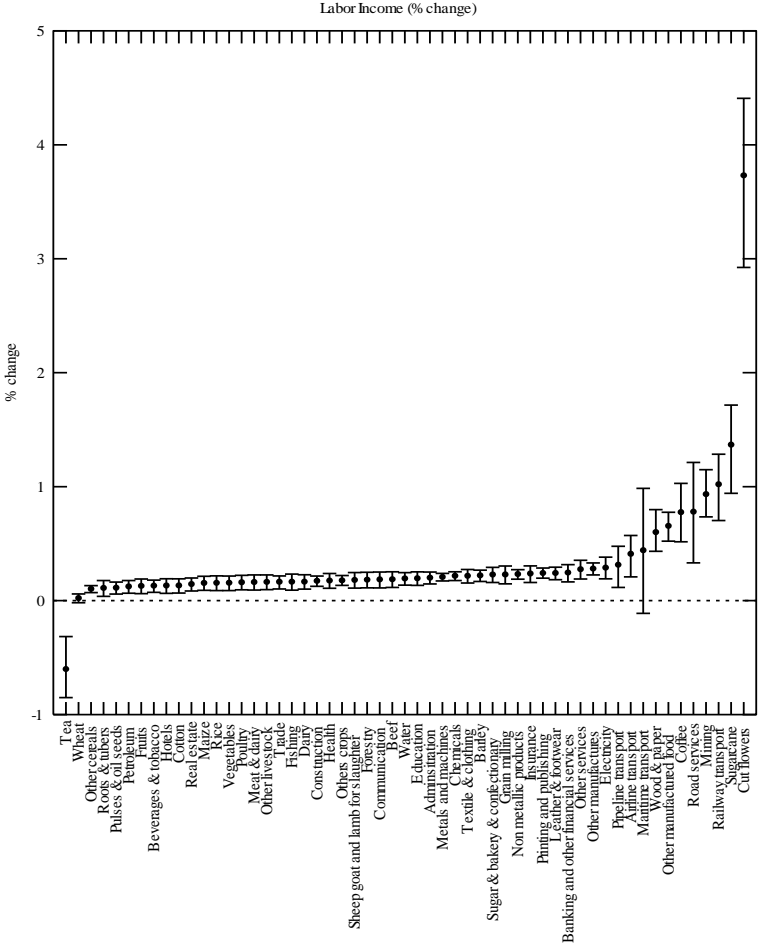


Figure 4: Means, 50 and 95 Percent Confidence Intervals of the Sample Frequency Distributions of the Output Changes by Sector from Kenyan Preferential Reduction of Services Barriers Against African Partners—30, 000 simulations.



Note: The boxes are limited vertically by the 25% and 75% quartiles. The bars in the box are the means. The vertical lines extend to the 2.5% and 97.5% percentiles.

Figure 5: Means, 50 and 95 Percent Confidence Intervals of the Sample Distributions of the Labor Payment Changes by Sector from Kenyan Preferential Reduction of Services Barriers Against African Partners—30,000 simulations.



Note: The boxes are limited vertically by the 25% and 75% quartiles. The bars in the box are the means. The vertical lines extend to the 2.5% and 97.5% percentiles.

Figure 6: Sample Frequency Distribution of the Welfare Results of Kenyan Preferential Reduction of Services Barriers Against EU Partners—30,000 simulations.

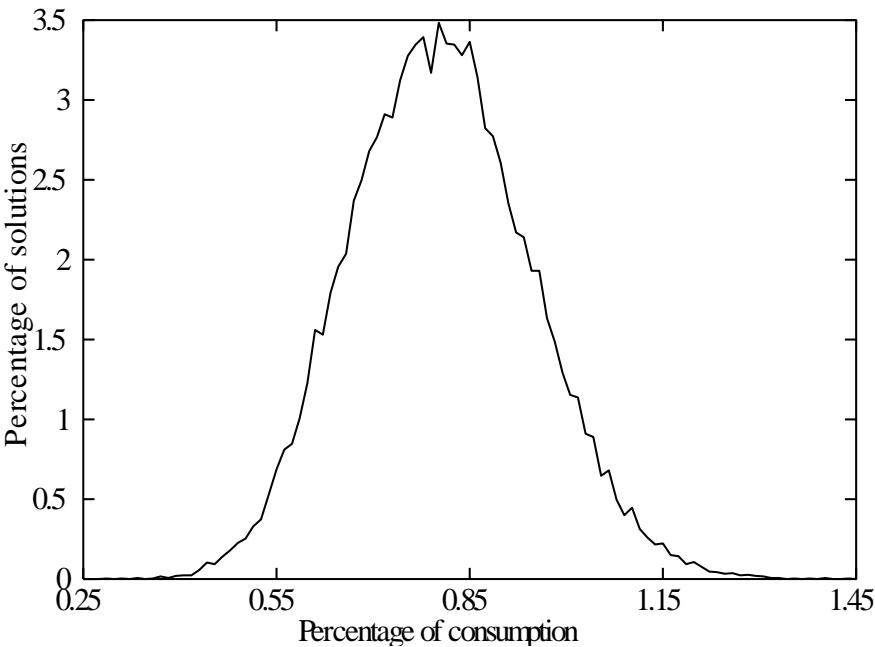
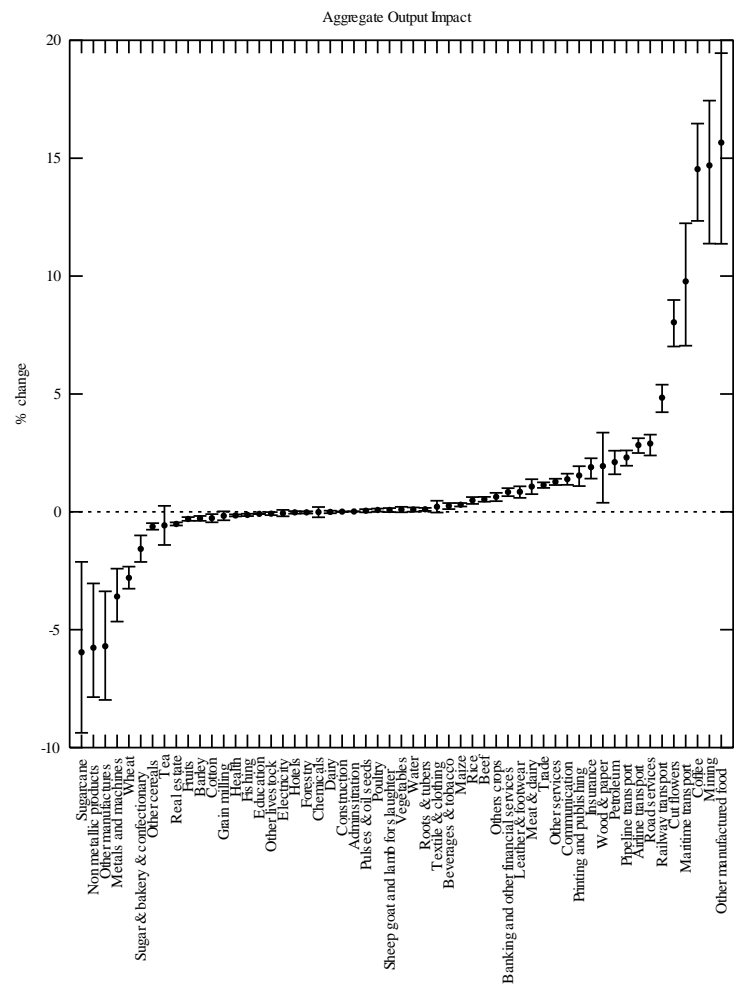
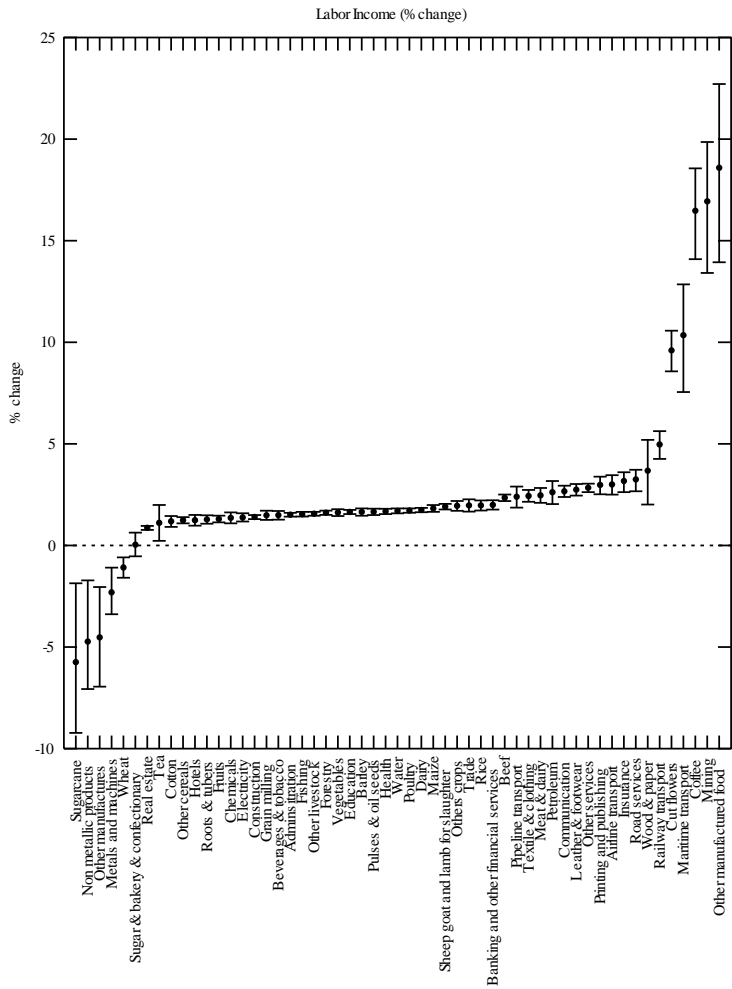


Figure 7: Means, 50 and 95 Percent Confidence Intervals of the Sample Distributions of the Output Changes by Sector from Kenyan Preferential Reduction of Services Barriers Against EU Partners—30,000 simulations.



Note: The boxes are limited vertically by the 25% and 75% quartiles. The bars in the box are the means. The vertical lines extend to the 2.5% and 97.5% percentiles.

Figure 8: Means, 50 and 95 Percent Confidence Intervals of the Sample Distributions of the Labor Payment Changes by Sector from Kenyan Preferential Reduction of Services Barriers Against EU Partners—30,000 simulations.



Note: The boxes are limited vertically by the 25% and 75% quartiles. The bars in the box are the means. The vertical lines extend to the 2.5% and 97.5% percentiles.

Appendices

Appendix A: Trade Share Data and Tariff Rates for Kenya's Trade Partners

Appendix B: Documentation of the Calculation of Ownership Shares for Kenya

Appendix C : Estimates of the Dixit-Stiglitz Elasticities of Substitution for Kenyan Imperfectly Competitive Goods

Appendix D: Engineering Services in Kenya - Restrictiveness Index

Appendix E: Data on Research and Development Expenditures and Sales for the United States in 2004 and 2005.

Appendix F: Kenya Model with Multiple FDI and Trade Partners (Algebraic Structure)

Appendix G: A Note of the Relationship Between Sector Specific Capital and the Elasticity of Supply in Applied General Equilibrium Models of Imperfect Competition

Appendix A: Trade Share Data and Tariff Rates for Kenya's Trade Partners

Trade Share Data

To obtain the shares of imports and exports from the different regions of our model, we used trade data for 2007 obtained from WITS access to the COMTRADE database.

The regions of our model are Kenya, the European Union, the East African Customs Union plus COMESA and the Rest of the World. For the European Union, we took the 27 member countries as of 2007. In this appendix, we calculate and report data for the East African Customs Union and COMESA separately. For the East African Customs Union, we took Tanzania, Uganda, Rwanda and Burundi. For COMESA, in order to avoid double counting, we took the COMESA countries less those in the East African Customs Union, i.e., Comoros, Congo, Djibuti, Egypt, Eritrea, Ethiopia, Libya, Madagascar, Malawi, Mauritius Seychelles, Sudan, Swaziland, Zambia and Zimbabwe. Trade shares for the "Africa" region in our model is the sum of East Africa Customs Union plus COMESA as defined above. Rest of the World is the residual.

We mapped two digit sectors from the COMTRADE database into the sectors of our model. The exact mapping is defined in the first table below.

We used Kenya as the reporter country for both exports and imports. Results for both exports and imports are reported in the subsequent three tables, by CRTS and IRTS goods in our model separately.

Tariff Rate Calculations

Tariff and Sales Tax Data. We started with MFN tariff rates at the eight digit level taken from the website of the Kenyan government: www.kra.go.ke/customs/customsdownloads.php. These tariff rates were then aggregated to the sectors of our model, using simple averages.

We obtained data on the total taxes on imports and the total value of imports and took the ratio to obtain the average value of import taxes in the Kenyan economy. In 2005, this was 8.4 percent.³⁰ That is, on average, Kenyan importers paid 8.4 percent of the value of imports on import taxes that did not apply to domestic production.

As we reported in Balestreri, Rutherford and Tarr (2009), the MFN tariff rates, multiplied times the trade flows, exceed the collected tariff rates. That is, using MFN tariff rates for all trade, the weighted average tariff rate exceeds the collected tariff rate of 8.4 percent for the economy as a whole. Thus, they exaggerate the protection received by Kenyan industry and agriculture. This is due to tariff preferences to regional partners and due to other preference items or tariff exemptions. We assume that zero tariffs apply

³⁰ Economic Survey (2006, pp. 103, 115).

on all imports from the East African Customs Union and from COMESA.³¹ Thus, we apply the MFN tariff rates only on the trade flows from outside of these African regions (EU and Rest of World in our model) and take a weighted average tariff rate of the MFN rates on the non-East African regions. The resulting weighted average tariff rate on non-East African imports still exceeds 8.4 percent. We then proportionally reduced all the MFN tariffs in our model so that the estimated collected tariffs on imports from the EU and Rest of World divided by the total value of import is 8.4 percent.

³¹ Kenya agreed to implement zero tariffs on East African Customs Union imports as of January 1, 2005. See Michael-Stahl (2005).

Notes on Product/Sector Classifications in SITC Revision 2

Product	SITC Classification (Rev. 2)
All goods	0 to 9
Dixit-Stiglitz Goods	
Beverages and tobacco	1
Food manufactures (excl. bev & tob) **	012+014++0224+023+024++0252+037+046 to 048+056+058+0612+ 0615+0619+062+0712+0722+0723+073+0812 to 0918+09+41+42+43
Printing and publishing	64
Mineral fuels	3
Chemicals	5
Metals and machines	67+68+69+7
Non-metallic products	66
Other manufactures (excl. CRTS sectors)	62+81+82+83+87+88+89
Agriculture (excl. food manuf & bev, tob)	0+1+2+4-27-28-1-above food manufacturing products
Other goods	All goods-Dixit/Stiglitz goods-above agriculture
Agricultural Products	
Maize	044
Wheat	041
Rice	042
Barley	043
Other cereals	045
Cotton	263
Sugar	061
Coffee	071
Tea	074
Roots and tubers	0548
Oil seeds and pulses	22
Fruits	057+058
Vegetables	054+056
Cut flowers	2927
Other crops	072+075+081
Beef	0111
Dairy products	02
Poultry	0114
Meats of sheep and goats	0112
Other livestock	00+0113+0115+0116+0118
Other CRTS Goods	
Fishing	03
Forestry	24+25
Mining	27+28
Meats and dairy	01+02
Grain milling	046+047
Sugar & bakery confectionary	062+073+048
Textiles and clothing	65+84
Leather and footwear	61+85
Wood and papers	63+64

Note: ** based on all processed and manufacturing food products

Kenyan Exports Values and Shares of Agricultural and Other CRTS Products in 2007

Product	Export value (\$ '000)					export shares				
	COMESA15	EAC5	EU27	ROW	WLD	COMESA15	EAC5	EU27	ROW	WLD
AGRICULTURE										
Maize	671	2,694	7	9,096	12,468	0.054	0.216	0.001	0.730	1.000
Wheat	2	43	0	119	164	0.013	0.264	0.000	0.723	1.000
Rice	203	318	5	86	613	0.332	0.519	0.009	0.140	1.000
Barley	0	654	0	0	654	0.000	1.000	0.000	0.000	1.000
Other cere:	453	107	8	309	877	0.517	0.122	0.009	0.352	1.000
Cotton	4	0	18	126	148	0.025	0.000	0.120	0.855	1.000
Sugar	10,573	8,616	19	336	19,545	0.541	0.441	0.001	0.017	1.000
Coffee	1,093	780	98,647	65,708	166,228	0.007	0.005	0.593	0.395	1.000
Tea	170,298	238	131,530	396,147	698,213	0.244	0.000	0.188	0.567	1.000
Roots and	1	24	7	0	32	0.022	0.739	0.229	0.010	1.000
Oil seeds a	14	157	4,831	3,007	8,009	0.002	0.020	0.603	0.375	1.000
Fruits	2,335	4,878	85,188	20,397	112,797	0.021	0.043	0.755	0.181	1.000
Vegetables	987	4,610	256,893	26,590	289,080	0.003	0.016	0.889	0.092	1.000
Cut flowers	22,982	8	316,343	50,929	390,262	0.059	0.000	0.811	0.130	1.000
Other crop:	737	3,739	1,233	2,733	8,442	0.087	0.443	0.146	0.324	1.000
Beef	287	528	0	484	1,299	0.221	0.406	0.000	0.372	1.000
Dairy prod:	3,002	10,337	25	3,340	16,704	0.180	0.619	0.001	0.200	1.000
Poultry	101	8	0	9	118	0.856	0.067	0.000	0.077	1.000
Meats of sl	101	283	0	86	469	0.214	0.603	0.000	0.183	1.000
Other lives:	150	1,876	69	1,013	3,108	0.048	0.604	0.022	0.326	1.000
OTHER CRTS GOODS										
Fishing	411	162	34,837	25,757	61,167	0.007	0.003	0.570	0.421	1.000
Forestry	412	483	4	169	1,068	0.386	0.452	0.004	0.159	1.000
Mining	2,305	29,358	21,162	21,545	74,369	0.031	0.395	0.285	0.290	1.000
Meats and	3,821	14,847	131	6,576	25,375	0.151	0.585	0.005	0.259	1.000
Grain millin	415	538	49	59	1,062	0.391	0.507	0.046	0.056	1.000
Sugar & ba	14,420	33,297	1,912	16,008	65,637	0.220	0.507	0.029	0.244	1.000
Textiles an	22,415	32,212	3,996	238,463	297,087	0.075	0.108	0.013	0.803	1.000
Leather an	14,512	28,989	15,930	31,441	90,872	0.160	0.319	0.175	0.346	1.000
Wood and	16,394	47,045	2,587	7,287	73,314	0.224	0.642	0.035	0.099	1.000

Source: Based on UN COMTRADE Statistics.

Kenyan Imports of Agricultural and Other CRTS Products in 2007

Product	Import value (\$ '000)					Import shares				
	COMESA15	EAC5	EU27	ROW	WLD	COMESA15	EAC5	EU27	ROW	WLD
AGRICULTURE										
Maize	625	14,194	0	1,445	16,265	0.038	0.873	0.000	0.089	1.000
Wheat	62	2	3,618	140,505	144,187	0.000	0.000	0.025	0.974	1.000
Rice	8,919	2,563	12	58,559	70,054	0.127	0.037	0.000	0.836	1.000
Barley	0	0	1	0	1	0.000	0.000	1.000	0.000	1.000
Other cereals	0	9,083	3	53	9,139	0.000	0.994	0.000	0.006	1.000
Cotton	214	4,322	0	119	4,655	0.046	0.929	0.000	0.026	1.000
Sugar	72,342	1,914	4,939	35,055	114,249	0.633	0.017	0.043	0.307	1.000
Coffee	41	635	78	1,347	2,101	0.020	0.302	0.037	0.641	1.000
Tea	0	86	22	8,088	8,196	0.000	0.011	0.003	0.987	1.000
Roots and tubers	0	29	662	205	896	0.000	0.032	0.739	0.228	1.000
Oil seeds and pulses	803	16,126	164	5,296	22,388	0.036	0.720	0.007	0.237	1.000
Fruits	1,492	2,848	2,444	7,358	14,141	0.105	0.201	0.173	0.520	1.000
Vegetables	1,589	19,450	5,546	22,592	49,177	0.032	0.396	0.113	0.459	1.000
Cut flowers	0	1,844	7	161	2,012	0.000	0.917	0.003	0.080	1.000
Other crops	55	9,461	2,337	4,599	16,452	0.003	0.575	0.142	0.280	1.000
Beef	0	0	0	0	0	0.000	0.000	1.000	0.000	1.000
Dairy products	693	458	779	3,437	5,367	0.129	0.085	0.145	0.640	1.000
Poultry	0	0	0	0	0	0.000	0.000	1.000	0.000	1.000
Meats of sheep and goats	0	0	0	8	8	0.000	0.000	0.000	1.000	1.000
Other livestock	67	36	246	1,787	2,136	0.031	0.017	0.115	0.836	1.000
OTHER CRTS GOODS										
Fishing	3,155	640	194	4,326	8,315	0.379	0.077	0.023	0.520	1.000
Forestry	1,084	16,979	4,388	9,851	32,301	0.034	0.526	0.136	0.305	1.000
Mining	518	1,272	1,774	33,094	36,658	0.014	0.035	0.048	0.903	1.000
Meats and dairy	781	458	868	5,143	7,249	0.108	0.063	0.120	0.709	1.000
Grain milling	10,092	1,341	4,728	19,656	35,817	0.282	0.037	0.132	0.549	1.000
Sugar & bakery confectionary	3,151	1,400	6,280	20,475	31,307	0.101	0.045	0.201	0.654	1.000
Textiles and clothing	4,815	18,592	10,903	279,109	313,418	0.015	0.059	0.035	0.891	1.000
Leather and footwear	170	117	551	20,191	21,029	0.008	0.006	0.026	0.960	1.000
Wood and papers	30,504	7,720	79,746	115,781	233,751	0.130	0.033	0.341	0.495	1.000

Source: Based on UN COMTRADE Statistics.

Kenyan Exports and Imports of Dixit-Stiglitz Goods and Other Products in 2007

Product	Trade value (\$ '000)					Trade Share				
	COMESA15	EAC5	EU27	ROW	WLD	COMESA15	EAC5	EU27	ROW	WLD
EXPORTS						EXPORTS				
All goods	664,849	952,788	1,084,812	1,378,351	4,080,800	0.163	0.233	0.266	0.338	1.000
Beverages	46,796	47,692	11,535	61,085	167,109	0.280	0.285	0.069	0.366	1.000
Food manu.	79,712	98,905	106,990	31,678	317,284	0.251	0.312	0.337	0.100	1.000
Printing and	9,987	41,596	129	3,635	55,347	0.180	0.752	0.002	0.066	1.000
Mineral fuel	15,225	86,515	139	72,263	174,143	0.087	0.497	0.001	0.415	1.000
Chemicals	68,878	175,389	1,057	106,367	351,691	0.196	0.499	0.003	0.302	1.000
Metals and	129,528	198,787	11,782	80,253	420,350	0.308	0.473	0.028	0.191	1.000
Non-metallic	10,513	87,666	5,697	10,639	114,515	0.092	0.766	0.050	0.093	1.000
Other manu.	45,774	88,777	26,412	32,468	193,431	0.237	0.459	0.137	0.168	1.000
Agriculture	211,253	29,739	877,333	627,966	1,746,291	0.121	0.017	0.502	0.360	1.000
Other goods	47,183	97,723	43,737	351,997	540,640	0.087	0.181	0.081	0.651	1.000
IMPORTS						IMPORTS				
All goods	332,205	191,598	1,812,340	6,653,119	8,989,262	0.037	0.021	0.202	0.740	1.000
Beverages	11,958	27,881	15,716	13,650	69,204	0.173	0.403	0.227	0.197	1.000
Food manu.	73,603	19,352	38,219	436,903	568,077	0.130	0.034	0.067	0.769	1.000
Printing and	30,462	7,634	69,199	88,868	196,163	0.155	0.039	0.353	0.453	1.000
Mineral fuel	45,727	427	60,393	1,811,868	1,918,415	0.024	0.000	0.031	0.944	1.000
Chemicals	58,989	4,172	322,652	754,982	1,140,796	0.052	0.004	0.283	0.662	1.000
Metals and	60,085	12,273	958,236	2,461,164	3,491,757	0.017	0.004	0.274	0.705	1.000
Non-metallic	5,118	491	30,219	90,373	126,201	0.041	0.004	0.239	0.716	1.000
Other manu.	7,117	2,616	152,026	257,025	418,784	0.017	0.006	0.363	0.614	1.000
Agriculture	33,340	96,683	64,962	328,230	523,215	0.064	0.185	0.124	0.627	1.000
Other goods	5,804	20,070	100,720	410,055	536,649	0.011	0.037	0.188	0.764	1.000

Source: Based on UN COMTRADE Statistics.

Appendix B: Documentation of the Calculation of Ownership Shares for Kenya

I. Telecommunications Shares in Kenya

The primary source of data was various publications of Paul Buddle Communications, including “Kenya—Telecoms Market Statistics and Forecasts,” March 20, 2008. Table 10 contains mobile phone subscription statistics by company and Table 2 lists the number of fixed-line phone subscribers. We defined market share as the share of total subscribers, summing fixed-line and mobile subscribers.

The telecommunications companies are: Telkom Kenya, Safaricom and Celtel. Ownership shares are as follows. France Telecom purchased 51% of Telkom Kenya in 2007 with the Government of Tanzania holding the remaining 49 percent.³² Vodafone held 35% of Safaricom network, with the remainder held by Telkom Kenya (60%) and a local company Mobitelea (5%).³³ “Celtel was acquired by MTC of Kuwait for US\$3.4 billion in March 2005”. MTC was later renamed “Zain Group”.³⁴

The results for market share by country (in percent) are as follows: Kenya, 26; EU, 49; EAC, 0; COMESA, 0; Rest of World, 25.

II. Bank Shares in Kenya.

Bank Market Shares

The data source for bank market shares was Bankscope, an on-line data source for about 29,000 banks world-wide.³⁵ Through Bankscope, we obtained data on total assets by bank in Kenya, owners -shareholders of the bank and the percent of the bank owned by each owner-shareholder. Market share of each bank was defined based on the bank’s assets as a share of total bank assets in the country. We divided the regions into the European Union, East African Customs Union, COMESA and Rest of the World.³⁶

Ownership Shares of Banks

Each bank’s market share was then allocated among geographic regions according to the shares of ownership of the bank. We then summed across the banks to obtain total market shares by region. In many cases, however, the Bankscope data were inadequate to allocate ownership shares by region. In these cases, we investigated bank websites, to obtain the required ownership information. The results of our supplementary inquiries are listed below.

The results we get are that owners of the banking sector of Kenya are as follows, in percent: Kenya, 61.8; EU, 28.7; EAC, 0; COMESA, 0.2; ROW, 9.3. Detailed results on the ownership of the banks are in the tables below.

³² http://www.orange.com/en_EN/press/press_releases/cp080917uk.html Accessed 17 April 2009

³³ See Paul Buddle Communications, “The Kenya Regulatory and Fixed-Line Telecoms Overview,” March 20, 2008.

³⁴ See Paul Buddle Communications, “The Kenya Mobile Market Overview,” March 20, 2008.

³⁵ It combines data from the main information provider, Fitch Ratings, and nine other sources, with software for searching and analysis. Each bank report contains balance sheet and income statements with up to 200 data items.

³⁶ Although we calculated data for the U.S. and the U.K. separately, these were aggregated into the Rest of the World and the European Union, respectively.

Table 1: Kenya Banking Sector Ownership Shares, by Region (1 of 6)

Bank	Shareholder (ISO Country Code)	Owner ship %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
ABN AMRO Bank NV	Abn Amro Holding Nv (NL)										
African Banking Corporation Limited	Queens Holdings Ltd (KE)	25.00	77,200	0.56%	0.56%						
African Mercantile Banking Company Limited - AMBANK											
Bank of Africa Kenya Limited			93,493	0.68%							
	African Financial Holding Sa-African	19.89					0.16%				
	Bank Of Africa - Madagascar (MG)	20.00							0.16%		
	Nederlandse Financierings-Maatsch	20.00					0.16%				
	Bank Of Africa - Côte D'Ivoire (CI)	15.00									0.12%
	Bank Of Africa - Benin (BJ)	10.11									0.08%
Bank of Baroda (Kenya) Ltd	Bank Of Baroda (IN)	86.70	169,651	1.23%							1.23%
Barclays Bank of Kenya Ltd			1,700,672	12.30%							
	Barclays Bank Plc (GB)	68.50				8.43%					
	Kenyan Public & Institutions (KE)	31.50			3.88%						
Biashara Bank of Kenya Limited											
Calyon	Calyon (FR)										
Central Bank of Kenya	Government Of Kenya (KE)	100.00	3,067,136	22.19%	22.19%						
CFC Stanbic Holdings Limited	Stanbic Africa Holdings Limited (GB)	60.00	581,708	4.21%		4.21%					
Charterhouse Bank Limited											
Chase Bank (Kenya) Limited	Chase Bank (Kenya) Limited (US)	100.00	59,405	0.43%						0.43%	
Citibank NA	Citibank Na (US)	100.00	544,612	3.94%						3.94%	
City Finance Bank Limited											
Commerce Bank Limited											
Commercial Bank of Africa	Commercial Bank of Africa (KE)	100.00	539,477	3.90%	3.90%						
Consolidated Bank of Kenya Limited	Consolidated Bank of Kenya (KE)	100.00	49,528	0.36%	0.36%						
Co-operative Bank of Kenya Ltd			831,354	6.01%							
	Co-Operatives Societies (??)	83.82									
	Individual Members Of Co-Operative	16.18									
Credit Bank Limited			37,606	0.27%							
Daima Bank Limited											
Development Bank of Kenya Ltd	Development Bank of Kenya (KE)	100.00	47,115	0.34%	0.34%						

Table 1: Kenya Banking Sector Ownership Shares, by Region (2 of 6)

Bank	Shareholder (ISO Country Code)	Owner ship %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
Diamond Trust Bank Kenya Limited			313,234	2.27%							
	Aga Khan Fund For Economic Development (KE)	17.32									0.76%
	Barclays (Kenya) Nominees Ltd (KE)	9.85			0.43%						
	Habib Bank Limited (PK)	9.72									0.43%
	The Jubilee Insurance Company Ltd (KE)	8.77			0.39%						
	Diamond Jubilee Investment Trust (C)	1.87				0.08%					
	Craysell Investments Ltd (KE)	1.62			0.07%						
	Noorali Mohan Manji (KE)	1.27			0.06%						
	Ameerali Nazarali Esmail (KE)	0.92			0.04%						
Dubai Bank Kenya Limited											
EABS Bank Limited			128,389	0.93%							
	Private Shareholders (KE)	65.59			0.61%						
	LP Holdings (KE)	16.95			0.16%						
	Rajmuk Holdings (KE)	9.41			0.09%						
	Emperor Holdings (KE)	8.05			0.07%						
East African Building Society - EABS											
Equatorial Commercial Bank Limited											
Equity Bank Limited	British-American Investments Company (UK)	11.06	288,544	2.09%	2.09%						
Euro Bank Limited											
Faulu Kenya Limited	Faulu Kenya Limited (CH)	70.00	29,829	0.22%							0.22%
Fidelity Commercial Bank Limited											
Fina Bank Limited			141,005	1.02%							
	Entreprise Banking Group (BW)	20.75									0.21%
	Dhabaria Ltd (KE)	19.81			0.20%						
	Rare Ltd (KE)	17.83			0.18%						
	Sirus Ltd (KE)	15.85			0.16%						
	Snow Point (K) Ltd (KE)	9.91			0.10%						
	Harupa Ltd (KE)	3.96			0.04%						
	Kushan Ltd (KE)	3.96			0.04%						
	Reena Ltd (KE)	3.96			0.04%						

Table 1: Kenya Banking Sector Ownership Shares, by Region (3 of 6)

Bank	Shareholder (ISO Country Code)	Owner ship %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
First American Bank of Kenya											
First National Finance Bank Ltd.											
Giro Commercial Bank Limited											
Guardian Bank Limited											
Guilders International Bank Limited											
Habib Bank Limited	Habib Bank Limited (PK)										
Housing Finance Company of Kenya Limited			142,700	1.03%							
	Equity Bank Limited (KE)	20.00			0.44%						
	National Social Security Fund (KE)	7.87			0.17%						
	Government Of Kenya (KE)	7.32			0.16%						
	Barclays (Kenya) Nominees Ltd 9347	4.90			0.11%						
	Northbound Holdings Ltd (??)	4.60									
	Steel Son Limited (KE)	3.55			0.08%						
	Nomura Nominees Ltd A/CJmm (KE)	3.15			0.07%						
	Ndungu Paul Wanderi (??)	2.35									
	Kibuwa Enterprises Ltd (??)	0.91									
	Kirinyaga Construction Ltd (KE)	0.52			0.01%						
Imperial Bank Limited			135,537	0.98%							
	Abdumal Investments Ltd (??)	14.00									
	Simba Colt Motors Limited (KE)	14.00			0.38%						
	Janco Investments Limited (??)	13.50									
	Kenblest Ltd (??)	12.50									
	Momentum Holdings Limited (KE)	12.50			0.34%						
	Rex Motors Ltd (??)	12.50									
	Ea Motor Industries (Sales & Service)	11.00									
	Reynolds & Co. Limited (IE)	10.00					0.27%				
Industrial and Commercial Development Corporation	Government Of Kenya (KE)	100.00									
Industrial Development Bank Limited											

Table 1: Kenya Banking Sector Ownership Shares, by Region (4 of 6)

Bank	Shareholder (ISO Country Code)	Owner ship %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
Investments and Mortgages Bank Limited - I&M Bank Limited			322,035	2.33%							
	Biashara Securities Ltd (KE)	21.55			0.53%						
	Minard Holdings Limited (KE)	17.54			0.43%						
	Tecoma Limited (KE)	15.72			0.38%						
	Ziyungi Limited (KE)	15.72			0.38%						
	Mnana Limited (KE)	14.52			0.36%						
	City Trust Limited (KE)	10.14			0.25%						
	Sachit Shah (??)	2.40									
	Sarit S. Shah (??)	2.40									
Kenya Commercial Bank LTD			1,333,300	9.64%							
	Permanent Secretary To The Treasury	26.23			5.87%						
	National Social Security Fund (KE)	6.80			1.52%						
	Stanbic Nominees Kenya Limited A/C	3.49			0.78%						
	Sunil Narshi Shah (??)	2.33									
	Kcb Staff Pension Fund (KE)	2.32			0.52%						
	Stanbic Nominees Kenya Limited A/C	1.53			0.34%						
	Nomura Nominees Ltd A/C Jmm (KE)	1.01			0.23%						
	Kenya Reinsurance Corporation Limited	0.87			0.19%						
	Barclays (Kenya) Nominees Ltd A/C 9	0.82			0.18%						
	Barclays (Kenya) Nominees Ltd A/C 1	0.69									
Kenya Commercial Finance Company Limited											
Kenya Post Office Savings Bank		100.00	215,015	1.56%	1.56%						
Kenya Women Finance Trust											
K-REP Bank			75,223	0.54%							
	African Development Bank (II)	15.14									0.41%
	Netherlands Dev. Finance Co (NL)	5.00					0.14%				
Middle East Bank Kenya Limited			49,015	0.35%							
	Fortis Bank (BE)	25.03					0.18%				
	Banque Belgo-laise-Belgo-laise Bank	25.00					0.18%				
National Bank of Kenya Ltd			520,526	3.77%							
	National Social Security Fund (KE)	48.00			2.58%						
	Government Of Kenya (KE)	22.00			1.18%						

Table 1: Kenya Banking Sector Ownership Shares, by Region (5 of 6)

Bank	Shareholder (ISO Country Code)	Owner ship %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
NIC Bank Limited			376,210	2.72%							
	First Chartered Securities Ltd (??)	16.44									
	Icea Investment Services Ltd (??)	9.42									
	Livingstone Registrars Ltd. (KE)	8.13			1.11%						
	Rivel Kenya Ltd (KE)	7.73			1.05%						
	Duncan Nderitu Ndegwa (??)	4.56									
	Saimar Ltd (KE)	4.13			0.56%						
	Amwa Holdings Ltd (??)	1.97									
	Kenya Commercial Bank Nominees L	1.65									
	Thuthuma Ltd (??)	1.27									
	Makimwa Consultants Ltd (??)	1.26									
Oriental Commercial Bank Ltd			20,886	0.15%							
	Pasha Investments Ltd (KE)	13.40			0.08%						
	Sag Investments Ltd (KE)	13.30			0.08%						
Paramount Universal Bank Limited											
Prime Bank			150,617	1.09%							
Prime Capital & Credit Limited											
Prudential Bank Limited											
Reliance Bank Limited											
Southern Credit Banking Corporation			66,003	0.48%							
	Others (??)	28.00									
	Fincity Investments Ltd (??)	23.00									
	Southern Shield Holdings Ltd (??)	20.00									
	Southern Shield Securities Ltd (??)	19.00									
	Sadrudin Karim Kurji (??)	10.00									
Stanbic Bank Kenya Limited		100.00	372,120	2.69%		2.69%					
Standard Chartered Bank Kenya			1,169,151	8.46%							
	Standard Chartered Holdings (Africa)	73.81					8.11%				
	Kabarak Limited (??)	1.03									
	Old Mutual Life Assurance Company	0.69			0.08%						
	National Social Security Fund (KE)	0.68			0.07%						
	Barclays (Kenya) Nominees Ltd A/C 1	0.59									
	Kenya Commercial Bank Nominees L	0.51			0.06%						
	Standard Chartered Africa Holdings L	0.48				0.05%					
	Barclays (Kenya) Nominees Ltd A/C 1	0.45			0.05%						
	Barclays (Kenya) Nominees Ltd A/C 9	0.36			0.04%						

Table 1: Kenya Banking Sector Ownership Shares, by Region (6 of 6)

[illegible]

Supplementary Information on Ownership Shares of Tanzanian Banks from Bank Websites

(Quotes are from the websites listed.)

National Microfinance – “Rabobank, 34.9%; The Government of the United Republic of Tanzania, 30.0%; Public, 21.0%; National Investment Company Limited (NICOL), 6.6%; Exim Bank Tanzania, 5.8%; Tanzania Chambers of Commerce Industries and Agriculture (TCCIA), 1.7%.

http://www.nmbtz.com/about_nmb/shareholder_information.html.

- CRDB Bank Plc – TZ 38.8% – shareholders are listed as follows:
“Private individuals, 37.0; Co operatives , 14.0; Companies, 10.2; DANIDA investment fund, 30.0; Parastatals (NIC & PPF), 8.8. ”
<http://www.crdbbank.com/aboutUs.asp> Accessed 3 April 2009.
- Commercial Bank of Africa –according to their website they are “wholly Kenyan owned.” http://www.cba.co.ke/default2.php?active_page_id=117
- Citibank NA – US 100%
- Kenya Post Office Savings Bank “The bank is wholly owned by the Government of Kenya and reports to the Ministry of Finance.”
<http://www.postbank.co.ke/index.php?do=about>.
- K-REP Bank “ International Finance Corporation, 16.7%; The African Development Bank, 15.1%; The Netherlands Dev. Finance Co. (FMO), 5.0%; Triodos, 11.0%; ShoreCap International, 8.2%; Kwa (ESOP), 10.0%; K-Rep Group, 25.0%; Founding Members, 5.2%. ICDC-I (Public investment company) 3.8%”
http://www.k-repbank.com/index.php?option=com_content&task=view&id=71&Itemid=109 .
- Chase Bank (Kenya) Limited – U.S. 100%
- Development Bank of Kenya Ltd – KE 100% - “Consequently after forty five years the bank ownership changed to one that is Kenyan owned and directed as follows; Industrial & Commercial Development Corporation (ICDC), 89.3%; Transcentury Ltd, 10.7%. ” <http://www.devbank.com/about.php?subcat=27&title=Shareholders>.

III. Kenyan Insurance Companies

The premium information came from the Insurance Industry Annual Report for 2007 of the Association of Kenya Insurers.³⁷ Table 9 of their report lists premium income by company and type of insurance. We define market share of a company by the company share of total market premia.

For ownership shares, we commissioned a survey from a specialist at the Association of Kenyan Insurers.³⁸ He provided the data on the ownership shares of the Kenyan companies. In the table below, we list the result of these calculations.

³⁷ Available at: <http://www.akinsure.com/images/aki-annual-report-2007.pdf>

³⁸ We thank Mr. Joseph Luvisia Jamwaka (a fellow of the Life Management Institute of the U.S. and Associate of the Chartered institute of Insurance of the UK) for providing this information.

Table 2: Kenya Insurance Sector Ownership Shares, by Region (1 of 7)

Insurance Company	Shareholder (ISO Country Code)	Owner ship %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
African Merchant Assurance Company			563	1.71%	1.71%						
	Hon. William Ruto (KE)	80.00									
	Silas Simatwo (KE)	20.00									
AIG Insurance Company	AIG (US)	100.00	1,801	5.48%						5.48%	
APA Insurance Company			2355	7.17%	7.17%						
	Apollo Insurance (KE)	60.00									
	Pan Africa Insurance Holdings (KE)	40.00									
Blue Shield Insurance Company			2,273	6.92%	6.92%						
	Beth Ngonyo Mungai (KE)	40.05									
	Bermuda Holdings Ltd (KE)	33.10									
	African Theatres Ltd (KE)	13.55									
	James Muigai Ngengi (KE)	3.31									
	Jean Muigai Ngengi (KE)	3.31									
	Peter Kamau Ngengi (KE)	3.31									
	Martha Vincent & Paul Vincent (KE)	3.31									
	Simon Evans Githinji (KE)	0.02									
	Simon Munyi Gachoki (KE)	0.01									
British American Insurance Company			679	2.07%							
	British America (K) Ltd (??)	66.67									
	Jimnah Mbaru (KE)	25.00			1.55%						
	Peter K Munga (KE)	5.00			0.31%						
	Benson I Wairegi (KE)	3.33			0.21%						
Cannon Assurance Company			557	1.70%	1.70%						
	Inderjit Talwar (KE)	0.00									
	Cannon Holdings (KE)	40.00									
	Evisa Investments (PVT) Ltd (KE)	28.70									
	PBM Nominees (KE)	31.30									
Concord Insurance Company			585	1.78%	1.78%						
	Dorse Gems International Inc (KE)	32.00									
	Kirumba Mwaura (KE)	36.00									
	James Gacheru (KE)	32.00									

Table 2: Kenya Insurance Sector Ownership Shares, by Region (2 of 7)

Insurance Company	Shareholder (ISO Country Code)	Owner ship %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
Co-operative Insurance Company			1,028	3.13%	3.13%						
	Harambee Co-operative Movement (KE)	9.06									
	Aembu Farmers Co-operative Society Ltd (KE)	8.30									
	Kiambu Unity Finance Co-operative Union (KE)	8.15									
	CIC Staff Co-operative Savings and Credit (KE)	7.27									
	The Co-operative Bank of Kenya (KE)	6.13									
	Bandari Co-operative Savings and Credit (KE)	3.34									
	Mwalimu Co-operative Savings and Credit (KE)	1.59									
	Kipsigis Teachers Savings and Credit (KE)	1.32									
	Nacico Savings and Credit Co-operative (KE)	1.10									
	Stima Savings and Credit Co-operative (KE)	1.09									
	Emmanuel Kipkemboi Birech (KE)	1.30									
	Isaac Waithaka Kamunya (KE)	1.12									
	Teresa Wanjiru Thimba (KE)	1.10									
	Leonard Obura Oloo (KE)	0.89									
	Gerald Mbaabu M'ikunyua (KE)	0.84									
	Francis Kamau Ng'ang'a (KE)	0.64									
	Others (KE)	46.76									
Corporate Insurance Company			351	1.07%	1.07%						
	Xanthippe Holdings Ltd (KE)	63.30									
	Ejax Investments Ltd (KE)	36.70									
CFC Life Assurance Company			674	2.05%							
	CfC Stanbic Holdings Group (GB)	60.00			1.23%						
	C Njonjo (KE)										
	U P Jani (KE)										
	J G Kiereini (KE)										
	J H D Milne (UK)										
	M Soundararajan (KE)										
	A Munda (KE)										
	R E Leahey (KE)										
Directline Assurance Company Ltd			259	0.79%	0.79%						
	Royal Credit Limited (KE)	99.70									
	Samuel S. K. Macharia (KE)	0.10									
	Purity G. Macharia (KE)	0.10									
	Dan Korobia (KE)	0.10									

Table 2: Kenya Insurance Sector Ownership Shares, by Region (3 of 7)

Insurance Company	Shareholder (ISO Country Code)	Owner ship %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
Fidelity Shield Insurance Company			684	2.08%	2.08%						
	Southern Shield Holdings Ltd (KE)	66.70									
	Southern Credit Banking Corp. (KE)	24.40									
	Soli Limited (KE)	6.40									
	Kenya Shipping Agency (KE)	1.40									
First Assurance Company			1,038	3.16%	3.16%						
	First Assurance Investment Ltd (KE)	83.00									
	Syndicate Nominee Ltd (KE)	17.00									
Gateway Insurance Company			436	1.33%	1.33%						
	Godfrey W Karuri (KE)	21.20									
	John N Muchuki (KE)	1.40									
	Bethuel M Gecaga (KE)	8.30									
	Muvokanza Limited (KE)	1.40									
	Eliud Ndirangu (KE)	4.30									
	Jerome P N Kariuki (KE)	0.30									
	Raymond Matiba (KE)	0.30									
	Francis Thuo (KE)	1.80									
	Kihara Waithaka (KE)	2.10									
	Mubiru Housing Company (KE)	0.90									
	Maina Kimere & Partners (KE)	5.40									
	Isaac G. Wanjohi (KE)	14.50									
	Wilson Kiragu (KE)	1.40									
	Chief Ezekiel N Onwere (KE)	7.60									
	Isaac Njoroge (KE)	0.60									
	James M Gacheru (KE)	1.10									
Geminia Insurance Company			460	1.40%	1.40%						
	Gikoi Development Co. Ltd (KE)	8.16									
	Mbagi Limited (KE)	34.70									
	Stanley M. Githunguri (KE)	26.53									
	Leonard M Kabetu (KE)	0.30									
	Bimal R. Shah (KE)	5.67									
	Harsha R. Shah (KE)	1.19									
	Hasit K Shah (KE)	1.38									
	Khetshi K Shah (KE)	1.38									
	Universal Roadways (K) Ltd (KE)	5.53									
	Kiriti Shah (KE)	2.67									
	Jay K Shah (KE)	1.38									
	Mona D Shah (KE)	1.38									
	Mona D Shah (KE)	5.68									
	Devchand A. Shah (KE)	2.67									

Table 2: Kenya Insurance Sector Ownership Shares, by Region (4 of 7)

Insurance Company	Shareholder (ISO Country Code)	Owner ship %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
General Accident Insurance			682	2.08%	2.08%						
	Rapun Limited (KE)	49.00									
	J S Insurance Limited (KE)	49.00									
	Shantilal Shah (KE)	2.00									
Heritage All Insurance Company			1505	4.58%							
	CFC (GB)	64.08				2.94%					
	African Liason Consultant Services (KE)	35.92			1.65%						
Insurance Company of East Africa	First Chartered Securities Limited (KE)	100.00	1,173	3.57%	3.57%						
Intra Africa Assurance Company			402	1.22%							
	Robert T. Gachecheh (KE)	10.50			0.18%						
	Archibald Githinji (KE)	7.50			0.13%						
	Mahendra Chandulal (KE)	5.00			0.09%						
	Upendra Ambalal Patel (KE)	5.00			0.09%						
	Jitenra Ambalal Patel (KE)	5.00			0.09%						
	Dinesh Chandulal Patel (KE)	10.00			0.17%						
	Henry Mkangi (KE)	3.00			0.05%						
	Bharat Kumar Patel (KE)	5.00			0.09%						
	Joseph Muriu (KE)	5.00			0.09%						
	Premji Ratna (KE)	5.00			0.09%						
	Ranjaben Suresh Patel (KE)	5.00			0.09%						
	Eleyo Saw Mills (??)	20.00									
	Praful C Patel (KE)	5.00			0.09%						
Invesco Insurance Company			958	2.92%							
Jubilee Insurance Company			2,450	7.46%							
	Jubilee Holdings Ltd (KE)	100.00			7.46%						
	Kenneth Hamish Wooler Shah (KE)	0.00									
	Neville Patrick Gibson Warren (IN)	0.00									
Kenindia Assurance Company			3,028	9.22%							
	Life Insurance Corp. Of India (IN)	10.00									0.92%
	General Insurance Corp Of India (IN)	9.00									0.83%
	New India Assurance Co. Ltd. (IN)	9.00									0.83%
	Oriental Insurance Co. Ltd. (IN)	9.00									0.83%
	United India Insurance Co. Ltd. (IN)	9.00									0.83%
	National Insurance Co. Ltd. (IN)	9.00									0.83%
	Pv Karia (IN)	1.39									0.13%
	M N Mehta (KE)	0.00			0.00%						
	M P Chandaria (KE)	0.00			0.00%						
	Sadasiv Mishra (KE)	0.00			0.00%						
	Simeon Nyachae (KE)	7.00			0.64%						
	Chandaria Foundation Trustees (KE)	7.01			0.65%						
	Mehta Group Of Companies (KE)	6.02			0.55%						
	Lex Holdings (KE)	3.66			0.34%						
	Others (KE)	20.00			1.84%						

Table 2: Kenya Insurance Sector Ownership Shares, by Region (5 of 7)

Insurance Company	Shareholder (ISO Country Code)	Owner ship %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
Kenya Orient Insurance Company			283	0.86%	0.86%						
	Thanak Investments (KE)	90.39									
	Rajwinder Singh (KE)	5.95									
	Avtar Singh Ubhi (KE)	1.80									
	Kahn Singh Ubhi (KE)	1.80									
	Luka Daudi Galgalo (KE)	0.06									
Kenya Alliance Insurance Company	International Controls Limited (??)	100.00	353	1.07%							
Lion of Kenya Insurance Company	First Chartered Security (KE)	80.00	1,217	3.71%	3.71%						
	Kenya Holdings (KE)	20.00									
Madison Insurance Company	Amedo Madison Holdings Limited (K	100.00	625	1.90%	1.90%						
Mayfair			273	0.83%	0.83%						
	Adrea Ltd (KE)	27.77									
	Corporate Investments (KE)	12.48									
	A 2 Enterprises (KE)	9.32									
	Tinker Bird Securities (KE)	9.15									
	Kazkazi Maritime Ltd (KE)	3.12									
	Union Logistics (KE)	3.12									
	Marenzo Ltd (KE)	8.32									
	Muhwai Ltd (KE)	6.55									
	Mahesh Doshi And Sheila Doshi (KE)	6.24									
	Nsp Holdings Ltd (KE)	6.24									
	Lakdawalla Investments Ltd (KE)	4.16									
	Bharasa Investments Ltd (KE)	3.54									
Mercantile Life & General Insurance			369	1.12%	1.12%						
	Ecobank Kenya Ltd (KE)	20.00									
	L.P Holdings (KE)	21.00									
	Barclays Trust (KE)	24.00									
	Eabs Bank (KE)	35.00									
Occidental Insurance Company			740	2.25%	2.25%						
	Park Enterprises Ltd (KE)	30.00									
	Oak Investments Ltd (KE)	15.00									
	Landsend Kenya Ltd (KE)	15.00									
	Hansing Ltd (KE)	15.00									
	Rock Investment Ltd (KE)	15.00									
	Ngamacu Ltd (KE)	5.00									
	Maganlal Lakhmshi Dodhia (KE)	2.50									
	Kantilal Maganlal Dodhia (KE)	2.50									

Table 2: Kenya Insurance Sector Ownership Shares, by Region (6 of 7)

Insurance Company	Shareholder (ISO Country Code)	Owner ship %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COME SA	US	ROW
Pacis Insurance Company Ltd			162	0.49%	0.49%						
	Luna Registered Trustees (KE)	35.87									
	Archdiocese Of Nairobi (KE)	32.56									
	Association Of Sisterhoods (KE)	5.42									
	Diocese Of Nakuru (KE)	4.65									
	Religious Superior Confrence (KE)	2.34									
	Diocese Of Muranga (KE)	2.20									
	Diocese Of Ngong (KE)	2.09									
	Diocese Of Kisii (KE)	1.71									
	Diocese Of Isiolo (KE)	1.63									
	Diocese Of Machakos (KE)	1.12									
	Diocese Of Nyahururu (KE)	1.00									
	Diocese Of Embu (KE)	0.90									
	Diocese Of Garissa (KE)	1.00									
	Diocese Of Marsabit (KE)	1.00									
	Archdiocese Of Kisumu (KE)	1.00									
	Catholic University Of East Africa (KE)	1.63									
	Others (KE)	4.00									
Pioneer Life Assurance Company			89	0.27%	0.27%						
	Rose Waruinge (KE)	9.00									
	Mtalaki Mwashimba (KE)	11.00									
	James Olubayi (KE)	80.00									
Phoenix of East Africa Assurance			525	1.60%	1.60%						
	Transworld Investment Limited (KE)	77.87									
	Kiruma International (KE)	8.93									
	Bawan Limited (KE)	3.40									
	Others (KE)	10.00									
Real Insurance Company			746	2.27%							
	Mureka Investments (KE)	69.00			1.57%						
	Zaniki Holdings Ltd (KE)	15.00			0.34%						
	The Globe Insurance Company (UK)	15.00				0.34%					
	Kenya Farmers Association (KE)	1.00			0.02%						
Standard Assurance Company			522	1.59%							

Table 2: Kenya Insurance Sector Ownership Shares, by Region (7 of 7)

[illegible]

IV. Railroad Transportation

In the hope of improved performance, in November 2006, Kenya's (and Uganda's) railways were turned over to Rift Valley Railways, a consortium led by South Africa's Sheltam Trade Close. This consortium won the right to operate the railways for 25 years. They are a monopolist, so **we infer 100 percent ownership to the Rest of the World.**³⁹

V. Pipeline Transportation

The Kenya Pipeline Company operates 800 kilometers of pipeline within Kenya for the transport of refined oil products. The pipeline runs from the refinery at the port of Mombassa to the capital of Nairobi, and with its western extension to Eldoret and to Kisumu. This pipeline is operated by the Kenya Pipeline Company, a wholly owned entity of the Government of Kenya.⁴⁰

In addition, there is a 320 kilometer pipeline under construction to extend the pipeline from Eldoret to Kampala Uganda. It is a Public-Private Partnership with the Governments of Uganda and Kenya originally each holding 24.5 percent shares. The remaining 51 percent was to be held by a consortium. Tamoil East Africa, a company registered in Uganda, owns 70 percent of the remainder. Tamoil East Africa is a wholly owned subsidiary of Tamoil Holdings, the Libyan state owned oil firm. The remaining 30 percent in the private consortium is held by Habib Investments, an investment company belonging to Habib Kagimu, a Ugandan businessman. However, in 2008, the Government of Uganda agreed to take only half of its 24.5 percent share and sell the other half to the private sector consortium. Thus, the share of the pipeline extension to Kampala of Tamoil East Africa increased to 44.3 percent and of Habib Investments to 19.0 percent.⁴¹

We assume that shares of the market are proportional to the kilometers of the pipeline, and allocate ownership shares accordingly. There are 1120 kilometers of pipeline. The finished pipeline is 60 percent of the total and the Kampala extension is 40 percent. The Kenyan government holds 100 percent ownership interest in 800 kilometers (or 60 percent of the total) and 24.5 ownership interest in the remaining 320 kilometers (or 9.8 of the total) for a total share of 69.8 percent. The Uganda ownership share is the sum of the share of the Government of Uganda and the share of Habib Investments, i.e., 12.5 percent (equals .4 * (12.25 + 19.0)). The results are as follows.

Kenya, 69.8; Uganda, 12.5; Rest of World, 17.7.

³⁹ On May 7, 2009, the Kenyan government announced it would like to renegotiate the contract and build (along with the government of Uganda) a second line to haul more cargo to the inland countries like Uganda, Rwanda and Burundi. See The New Vision, May 7, 2009. Available at: <http://www.newvision.co.ug/D/8/220/680519>.

⁴⁰ See Kenya Pipeline Company on Wikipedia at: http://en.wikipedia.org/wiki/Kenya_Pipeline_Company, and the company website at: <http://www.kpc.co.ke/>

⁴¹ See "Uganda cedes stake of oil pipeline to Tamoil of Libya, local investors," Libya On-Line, July 21, 2008. Available at: <http://www.libyaonline.com/news/details.php?cid=75&id=4830>

Appendix C : Estimates of the Dixit-Stiglitz Elasticities of Substitution for Kenyan Imperfectly Competitive Goods

Formatted: Right: 0.63"

It was necessary for us to obtain estimates of the Dixit-Stiglitz product variety elasticities of substitution for the imperfectly competitive sectors in our model. Christian Broda, Joshua Greenfield and David Weinstein (2006) estimated Dixit-Stiglitz product variety elasticities of substitution at the 3 digit level in 73 countries. Among the 73 countries, there were four in sub-Saharan Africa: the Central African Republic, Madagascar, Malawi and Mauritius. We judged that Madagascar was the country closest in characteristics to Kenya, so we took the values of the elasticities estimated for Madagascar as a proxy for the elasticities for Kenya.

Broda et al., estimate 3 digit elasticities for 130 goods sectors, but there are 34 goods sectors in our model. It was necessary to map the sectors estimated by Broda et al. into the sectors of our model. In table C1 of this appendix, we show the mapping for the imperfectly competitive sectors. (These elasticities are not relevant in our model for perfectly competitive sectors.)

Next, since there are often multiple sectors from Broda et al. mapped into a single sector in our model, it was necessary to determine a method of weighting the Broda et al. elasticities. There are reasons to use both export shares as well as import shares. A larger share of a subcategory in imports reflects more imports, and more likely there are more varieties of imports. So weighting by the import share of a subcategory is better than an unweighted measure. Domestic varieties are also important. Since we do not have production data for the subcategories, we use export shares as a proxy for domestic production by subcategory. Analogously, weighting subcategories by export shares is better than unweighted categories. Since both import shares and export shares are useful in the weighting, we take one half the shares of both exports and imports as the weights. The resulting elasticities are reported in table C1.

Broda, Christian, Joshua Greenfield and David Weinstein (2006), "From Groudnuts to Globalization: A Structural Estimate of Trade and Growth," National Bureau of Economic Research Working Paper 12512. Available at:
<http://faculty.chicagobooth.edu/christian.broda/website/research/unrestricted/TradeElasticities/TradeElasticities.html>.

Table C1: Estimated Elasticities of Substitution for Varieties in Kenyan Imperfectly Competitive Goods Sectors		
Sector in our Model	Matching HS-3 Code from Broda et al estimates	weighted elasticity of substitution
Beverages & tobacco	220, 240	2.3
Petroleum	271	3.6
Chemicals	280-391, 390, 393	2.8
Metals and machines	720-854	16.7
Non metallic products	680-702	5.6
Grain milling	110	3.2
Sugar & bakery & confectionary	170	2.9
Source: Authors calculations based on estimates from Broda, Greenfield and Weinstein (2006).		

Appendix D: Engineering Services in Kenya - Restrictiveness Index

The components of the engineering restrictiveness index as well as the scoring options are presented in Table D1.

Table D1: Professions Restrictiveness Index

Weight - foreign index	Weight - domestic index	Score	Restriction
<i>Barriers to establishment</i>			
0.0800	0.0800		Form of establishment
		1.00	Prohibition on incorporation
		0.50	Some form of incorporation permitted
		0.00	No restrictions
0.0800			Foreign partnership/association/joint venture
		1.00	Prohibition on partnership/association/joint venture with foreign professionals
		0.50	Partnership/joint venture with foreign professionals required
		0.00	No restrictions
0.0500			Investment and ownership by foreign professionals
			The score will be proportional to maximum equity participation permitted in a professional firm. For example, ownership to a maximum of 49 per cent of law firm would receive a score of 0.51.
0.0500	0.0500		Investment and ownership by non-professional investors
			The score will be proportional to maximum non-professional equity participation permitted in a professional firm. For example, ownership to a maximum of 49 per cent of law firm would receive a score of 0.51.
0.1350			Nationality/citizenship requirements
		1.00	Nationality required to qualify, become member of professional body, or to practice
		0.25	Nationality required to obtain professional title, but practice is relatively free
		0.00	No restrictions
0.1350			Residency and local presence
		1.00	Permanent or prior residency (more than 12 months) required
		0.75	Less than 12 months prior residency
		0.50	Prior residency required for local training
		0.25	Domicile or representative office only
		0.00	No restrictions
0.1000			Quotas/economic tests on the number of foreign professionals and firms
		1.00	Quotas/economic needs tests
		0.50	Some restrictions apply
		0.00	No restrictions

Weight - foreign index	Weight - domestic index	Score	Restriction
0.1000			Licensing and accreditation of foreign professionals
		1.00	Local retraining required for full license
		0.75	Local examination required in all cases
		0.50	Case by case assessment of foreign qualification/licence
		0.25	Aptitude tests
		0.00	Foreign licence/qualifications sufficient to practice
	0.0500		Licensing and accreditation of domestic professionals (scores additive)
		0.25	Compulsory membership of professional association
		0.25	Professional examination requirements
		0.25	Practical experience requirements
		0.25	Higher education requirements
0.0200			Movement of People - Permanent
		1.00	No entry of executives, senior managers or specialists
			Executives, specialists or senior managers can stay a period of up to 1 year
		0.80	
			Executives, specialists or senior managers can stay a period of up to 2 years
		0.60	
			Executives, specialists or senior managers can stay a period of up to 3 years
		0.40	
			Executives, specialists or senior managers can stay a period of up to 4 years
		0.20	
			Executives, specialists or senior managers can stay a period of 5 or more years
		0.00	
			<i>Barriers to ongoing operations</i>
0.0500	0.0500		Activities reserved by law to the profession
		1.00	4 core activities and over
		0.75	3 core activities
		0.50	2 core activities
		0.25	1 core activity
		0.00	None
0.0500	0.0500		Multidisciplinary practices
		1.00	Prohibition on partnership with other professionals
		0.50	Majority partnership required
		0.00	No restrictions
0.0500	0.0500		Advertising, marketing and solicitation
		1.00	Advertising, marketing and solicitation restricted
		0.50	Some form of advertising, marketing or solicitation allowed
		0.00	No restrictions

Weight - foreign index	Weight - domestic index	Score	Restriction
0.0500	0.0500		Fee setting
		1.00	Mandatory minimum or maximum fees
		0.50	Restrictions for some groups or activities
		0.00	No restrictions
0.0200			Licensing requirements on management
			All directors/managers or at least a majority of them must be nationals or residents
		1.00	
		0.75	At least one director/managers must be nationals or residents
		0.50	Directors and managers must be locally licensed
		0.25	Directors and managers must be domiciled
0.0200		0.00	No restrictions
			Other restrictions (scores additive)
		0.33	Restrictions on hiring professionals
		0.33	Restrictions on the use of firm's international names
		0.33	Government procurement - restrictions towards foreigners
0.0100		0.00	No restrictions
			Movement of people - Temporary
		1.00	No temporary entry of executives, senior managers or specialists
			Temporary entry of executives, senior managers or specialists up to
		0.75	30 days
			Temporary entry of executives, senior managers or specialists up to
		0.50	60 days
			Temporary entry of executives, senior managers or specialists up to
		0.25	90 days
			Temporary entry of executives, senior managers or specialists over 90 days
1.0000	0.3800		Total

Source: Nguyen-Hong (2000).

The scoring for Kenya is described below. It is based on the results of the World Bank Regulatory Survey in East Africa⁴² and the World Bank Survey on Applied Policies in Services⁴³.

Barriers to establishment

Form of establishment Score 0.5

Foreign service providers are required to incorporate or establish the businesses locally. There are no restrictions on forms of incorporation.

Foreign partnership/joint venture/association Score 0

No restrictions.

Investment and ownership by foreign professionals Score 0

No restrictions.

Investment and ownership by non-professional investors Score 0.5

An engineering/ consulting firm must have at least one Partner/Director registered as Consulting Engineer who has in force an Annual Practicing Licence in the specified disciplines.

Nationality/citizenship requirements Score 0

No restrictions.

Residency and local presence Score 0

No restrictions.

Quotas/economic tests on the number of foreign professionals and firms Score 1

Entry permits are issued to non-citizens with skills not available at present in the Kenya (class A entry permits for management and technical staff - horizontal measure in Immigration Act Cap 172).

Licensing and accreditation of domestic professionals Score 1

Membership in association is compulsory. Professional examination, practical experience and proof of higher education are required.

Licensing and accreditation of foreign professionals Score 0.75

Foreign professionals must be registered members of the Engineers Association. Foreign professionals must be holder of a diploma, degree or other qualification recognized by the Association of Engineers of Kenya.

Movement of people - permanent Score 0.5

There are limits on the duration of stay; in general, duration of stay is determined on a case by case basis.

On-going operations

Activities reserved by law to the profession Score 1

⁴² The regulatory surveys were conducted by local consultants who interviewed the professional associations in the examined East African countries in 2009.

⁴³ The policy surveys were conducted by DECRG in 2008-2009.

The engineering profession has an exclusive right to perform the following services: design and planning, representation for obtaining permits (signature of designs), tender and contract administration, project management including monitoring of execution, planning and managing maintenance, survey sites, testing and certification and expert witness activities. There is no law prohibiting a foreign provider with a commercial presence in Kenya from providing these services. The engineering profession has a shared right to provide the following services: feasibility studies, environmental assessment, and construction cost management. There is no law prohibiting a foreign provider with a commercial presence in Kenya from providing these services. Apart from design and planning, which can be done elsewhere and sent to Kenya, a foreign provider supplying services (i.e., without commercial presence in Kenya) will need a work permit in order to provide these services.

Multidisciplinary practices Score 0

There are no restrictions on cooperation between engineering professionals and other professionals. The same applies to foreign suppliers.

Advertising, marketing and solicitation Score 1

Advertising and marketing by Kenyan professional engineers as well as foreign suppliers is prohibited.

Fee setting Score 0.5

Prices /fees in the engineering services applicable to the private sector and other institutions outside the government are not regulated. In the case of professional engineering services rendered to the government, prices/fees are determined the Ministry in charge of engineering services but as of 2010, this function will be performed by the Engineering Registration Board (ERB). The ERB will set the prices/fees to be paid for professional engineering services rendered to the government; the service providers will be expected to compete on the technical aspect only.

Licensing requirements on management Score 0

No restrictions.

Movement of people - Temporary Score 0

No restrictions.

Other restrictions (Addition categories) Score 0.33

Restrictions on hiring professionals: Investment Promotion Act 2004 (cap 172) section 13.1. The employment of foreign natural persons for the implementation of foreign investment shall be agreed upon by the contracting parties and approved by Government.

Sources:

- Dee, P. (2005), "A compendium of barriers to services trade", prepared for the World Bank, http://www.crawford.anu.edu.au/pdf/staff/phillippa_dee/Combined_report.pdf
- Nguyen-Hong, D. (2000), "Restrictions on Trade in Professional Services", Productivity Commission Staff Research Paper, Ausinfo, Canberra. Available at: <http://www.pc.gov.au/research/staffresearch/rotips>
- World Bank Regulatory Survey in East Africa conducted in the context of the Project "Trade in Professional Services in East Africa" in 2009.
- World Bank Survey on Applied Policies in Services conducted by Development Research Group, in 2008-2009.

Formatted: Left, Indent: First line: 0"

Appendix E: Data on Research and Development Expenditures and Sales for the United States in 2004 and 2005.

TABLE E1. Funds for industrial R&D and sales for companies performing industrial R&D in the United States, by industry: 2004 and 2005

Industry and company size	NAICS codes	All R&D			Sales in \$millions in 2005	Ratio of R&D expenses to sales (x 1,000)
		2004	2005	2004-2005 average		
		\$millions				
All industries	21-23, 31-33, 42, 44-81	208,301	226,159	217,230	6,119,133	36
Manufacturing industries	31-33	147,288	158,190	152,739	3,998,256	38
Food	311	2,254	2,716	2,485	374,342	7
Beverage and tobacco products	312	555	539	547	38,003	14
Textiles, apparel, and leather	313-16	570	816	693	51,639	13
Wood products	321	D	D	0	27,002	0
Paper, printing, and support activities	322, 323	D	D	0	159,608	0
Petroleum and coal products	324	1,603	D	802	404,317	2
Chemicals	325	D	42,995	21,498	624,344	34
Pharmaceuticals and medicines	3254	31,477	34,839	33,158	273,377	121
Plastics and rubber products	326	D	1,760	880	90,176	10
Nonmetallic mineral products	327	787	894	841	50,344	17
Primary metals	331	727	631	679	110,960	6
Fabricated metal products	332	1,512	1,375	1,444	174,165	8
Machinery	333	6,579	8,531	7,555	230,941	33
Computer and electronic products	334	48,296	D	24,148	472,330	51
Electrical equipment, appliances, and components	335	2,664	2,424	2,544	101,398	25
Transportation equipment	336	D	D	0	957,051	See note
Motor vehicles, trailers, and parts	3361-63	15,677	D	7,839	646,486	12
Aerospace products and parts	3364	13,086	15,005	14,046	227,271	62
Other transportation equipment	other 336	D	D	0	83,294	0
Furniture and related products	337	408	400	404	48,534	8
Miscellaneous manufacturing	339	4,388	5,143	4,766	83,103	57
Medical equipment and supplies	3391	3,343	4,374	3,859	56,661	68
Other miscellaneous manufacturing	other 339	1,045	769	907	26,442	34
		All R&D				
Industry and company size	NAICS codes	2004	2005	2004-2005 average		
		\$millions				
Nonmanufacturing industries	21-23, 42, 44-81	61,013	67,969	64,491	2,120,877	30
Mining, extraction, and support activities	21	D	D	0	33,665	0
Utilities	22	202	210	206	223,395	1
Construction	23	1,481	D	741	57,187	13
Wholesale trade	42	D	D	0	107,485	0
Retail trade	44, 45	1,596	D	798	232,150	3
Transportation and warehousing*	48, 49	D	D	0	79,436	See Note
Information	51	22,593	23,836	23,215	445,489	52
Finance, insurance, and real estate	52, 53	1,708	3,030	2,369	580,380	4
Professional, scientific, and technical services	54	28,709	32,021	30,365	261,500	116
Architectural, engineering, and related services	5413	4,265	4,687	4,476	50,121	89
Computer systems design and related services	5415	11,575	13,592	12,584	136,376	92
Scientific R&D services	5417	11,355	12,299	11,827	34,516	343
Other professional, scientific, and technical services other	54	1,514	1,444	1,479	40,487	37
Health care services	621-23	500	989	745	25,076	30
Other nonmanufacturing ^b	55, 56, 61, 624, 71, 72, 81	1,595	2,137	1,866	75,115	25

*We evaluate transportation as a medium R&D sector since three sectors dominate R&D expenditures of US multinationals operating abroad. These are transportation, chemicals and computers and electronics. Moreover, about two-thirds of all R&D expenditures of foreign multinationals operating in the US was performed in the same three sectors. See "U.S. and International Research and Development: Funds and Technology Linkages," at <http://www.nsf.gov/statistics/seind04/c4/c4s5.htm>.

SOURCE: Calculated from data in National Science Foundation, Division of Science Resources Statistics, *Survey of Industrial Research and Development: 2005, Data Tables*. Available at http://www.nsf.gov/statistics/nsf10319/content.cfm?pub_id=37508&id=3.

Appendix F:

Kenya Model with Multiple FDI and Trade Partners

Edward J. Balistreri
Colorado School of Mines

Thomas F. Rutherford
ETH-Zürich

David G. Tarr
The World Bank

June 2010

This document presents the algebraic formulation of a general-equilibrium numeric-simulation model of the Kenya economy. The model is currently under development by the authors. An earlier version of this model was used to analyze unilateral services liberalization in Kenya [Balistreri et al. (2009)]. The model now includes features that allow for an analysis of regional trade agreements.

The model includes 55 goods and services, which are purchased by households, firms, and the government. Let the goods and services be indexed by $g \in G$. Divide these goods and services into the following three categories that define their treatment in the model formulation: (*i.*) Business Services, characterized by monopolistic competition and foreign direct investment (FDI), indexed by $i \in I \subset G$; (*ii.*) Dixit-Stiglitz manufacturing sectors, characterized by monopolistic competition, indexed by $j \in J \subset G$; and (*iii.*) Constant Returns To Scale (CRTS) goods indexed by $k \in K \subset G$. In the current aggregation there are 9 elements in I , 7 elements in J , and 39 elements in K . Goods and services are also classified by their associated region, indexed by $r \in R$, where there are 4 regions.¹ The accounts track the incomes of 10 rural and 10 urban households, indexed by $h \in H$, and

¹The current formulation includes Kenya or the domestic region (D), the European Union (EU), important African trade partners (AFR), and the rest-of-world region (ROW), such that $R = \{D, EU, AFR, ROW\}$.

there are 5 primary factors of production indexed by $f \in F$.

Table 1 summarizes the equilibrium conditions and associated variables. The non-linear system (of 1,364 equations and variables) is formulated in GAMS/MPSGE and solved using the PATH algorithm. We proceed with a description and algebraic representation of each of the conditions itemized in Table 1.

1 Dual representation of technologies and preferences

Technologies and preferences are represented in the Kenya model through value functions that embed the optimizing behavior of agents. Generally, any linearly-homogeneous transformation of inputs into outputs is fully characterized by a unit-cost (or expenditure) function. Setting the output price equal to optimized unit cost yields the equilibrium condition for the activity level of the transformation. That is, a competitive constant-returns activity will increase up to the point that marginal benefit (unit revenue) equals marginal cost. In the case of the Kenya model not all transformations are constant returns, so there are exceptions. In general, however, we will use the convention of setting unit revenues (left-hand side) equal to unit cost (right-hand side) and associating this equilibrium condition with a transformation activity level.

Agents in Kenya wishing to purchase a particular good or service g face an aggregate price PA^g . Let ts^g equal the sales tax rate such that $(1 - ts^g)PA^g$ is the net-of-tax price of the aggregate of domestic, foreign, and FDI (if applicable) varieties of g . In constructing the aggregate, we will rely on the following notation for the component prices:

- PD^g Gross price of domestic output ($\forall g \in G$),
- PM_r^g Gross price of cross-border imports from region r of Business Services and CRTS goods ($\forall g \in (I \cup K)$),
- P_r^g Dixit-Stiglitz price index on region- r varieties ($\forall g \in (I \cup J)$).

Table 1: General equilibrium conditions

Equilibrium Condition	(Equation)	Associated Variable	Dimensions
Dual representation of preferences and technologies:			
Armington unit-cost functions	(1) $\forall i \in I$	A^g : Armington Activity	G
	(2) $\forall j \in J$		
	(3) $\forall k \in K$		
Dixit-Stiglitz price indexes	(4) $\forall g \in (I \cup J)$	Q_r^g : D-S Activity by region	$(I + J) \times R$
Zero Profits for Dixit-Stiglitz firms	(5) $\forall g \in (I \cup J)$	N_r^g : Number of Firms	$(I + J) \times R$
Dixit-Stiglitz composite input prices	(6) $\forall g \in (I \cup J)$ and $r = D$	Z_r^g : IRTS resource use	$(I + J) \times R$
	(7) $\forall j \in J$ and $r \neq D$		
	(8) $\forall i \in I$ and $r \neq D$		
Input-output technologies	(9) $\forall g \in G$	Y^g : Production level	G
Constant elasticity of transformation	(10) $\forall k \in K$	X^g : Index on CET activity	G
	(11) $\forall g \in (I \cup J)$	(No Export Coefficients for $g \in (I \cup J)$)	
Exports	(12) $\forall k \in K$ and $r \neq D$	EX_r^g : Exports	$G \times (R - 1)$
	(13) $\forall g \in (I \cup J)$ and $r \neq D$		
Imports	(14) $\forall g \in G$ and $r \neq D$	IM_r^g : Imports (net of FDI-firm imports)	$G \times (R - 1)$
Unit expenditure function	(15)	U : Household utility index	1
Unit cost of public purchase	(16)	PUB : Government Activity	1
Unit cost of investment	(17)	INV : Investment Activity	1
Market clearance conditions:			
Composite goods and services	(18) $\forall g \in G$	PA^g : Composite price indexes	G
D-S composites	(19) $\forall g \in (I \cup J)$ and $r \neq D$	P_r^g : Prices of D-S composites	$(I + J) \times R$
	(20) $\forall g \in (I \cup J)$ and $r = D$		
Markets for IRTS composite input	(21) $\forall g \in (I + J)$	PMC^g : Composite input prices	$(I + J) \times R$
Markets for domestic output	(22) $\forall k \in K$	PD^g : Domestic output prices	G
	(23) $\forall i \in I$		
	(24) $\forall j \in J$		
Markets for export output	(25) $\forall k \in K$ and $r \neq D$	PX_r^k : Export output prices	$K \times (R - 1)$
Markets for gross output	(26) $\forall g \in G$	PY_r^g : Output prices	G
Markets for imports	(27) $\forall i \in I$ and $r \neq D$	PM_r^g : Import prices	$G \times (R - 1)$
	(28) $\forall j \in J$ and $r \neq D$		
	(29) $\forall k \in K$ and $r \neq D$		
Factor markets	(30) $\forall f \in F$	PF_f : Factor prices	F
IRTS specific factors	(31) $\forall g \in (I \cup J)$	PZ_r^g : Sector-specific capital price	$(I + J) \times R$
Fixed real investment	(32)	$PINV$: Unit cost of investment	1
Fixed real public spending	(33)	PG : Unit cost of public good	1
Enterprise owner transfers	(34)	PE : Price of a claim on firm income	1
Nominal utility equals Income	(35)	PC : Unit expenditure index	1
Balance of payments	(36)	PFX : Price of foreign exchange	1
Income balance:			
Domestic agent income	(37) $\forall h \in H$	RA_h : Household Income	H
Government budget	(38)	$GOVT$: Government spending	1
Enterprise income	(39)	ENT : Enterprise income	1
Foreign Entrepreneur	(40)	FE : External agent income	1
Auxiliary Conditions:			
Fixed real public spending	(41)	T : Index on direct taxes	1
Foreign Savings	(42)	KA : Capital Account	1
Total Dimensions:	$6G + 6[(I + J) \times R] + 3[G \times (R - 1)] + [K \times (R - 1)] + F + H + 13 =$		1,364

Assuming a Constant Elasticity of Substitution (CES) aggregation of the components we equate the net-of-tax prices to the CES unit-cost functions:

$$(1 - ts^g)PA^i = \left(\sum_r (P_r^i)^{1-\sigma_F^i} + \sum_r \phi_r^i (PM_r^i)^{1-\sigma_F^i} \right)^{1/(1-\sigma_F^i)} \quad (1)$$

$$(1 - ts^g)PA^j = \left(\sum_r (P_r^j)^{1-\sigma_F^j} \right)^{1/(1-\sigma_F^j)} \quad (2)$$

$$(1 - ts^g)PA^k = \left(\phi_D^k (PD^k)^{1-\sigma_{DM}^k} + \sum_r \phi_r^k (PM_r^k)^{1-\sigma_{DM}^k} \right)^{1/(1-\sigma_{DM}^k)}, \quad (3)$$

where $\sigma_F^g \forall g \in (I \cup J)$ is the Dixit-Stiglitz elasticity of substitution and σ_{DM}^k is the Armington elasticity of substitution on CRTS goods. The arguments of these functions are the component prices. The ϕ parameters are CES distribution parameters that indicate scale and weighting of the arguments. These are calibrated to the Kenyan social accounts such that the accounts are replicated in the benchmark equilibrium.

For the IRTS sectors we have the Dixit-Stiglitz price indexes. These are functions of the number of varieties, firm-level costs, and the optimal markup. Assuming each firm is small relative to the size of the market the demand elasticity for a firm's variety is σ_F^g and the optimal markup over marginal cost is given by $1/(1 - \frac{1}{\sigma_F^g})$. Let marginal cost equal $PMC_r^g \forall g \in (I \cup J)$, which is the price of a composite input to the Dixit-Stiglitz firms associated with region- r , and let the number of varieties by region equal $N_r^g \forall g \in (I \cup J)$. The price indexes for the Dixit-Stiglitz goods are thus given by

$$P_r^g = \left[N_r^g \left(\frac{PMC_r^g}{1 - \frac{1}{\sigma_F^g}} \right)^{1-\sigma_F^g} \right]^{1/(1-\sigma_F^g)} \quad \forall g \in (I \cup J). \quad (4)$$

In equilibrium, the number of varieties by region adjusts such that we have zero profits. Denote the Dixit-Stiglitz composite activity level associated with equation (4) by $Q_r^g \forall g \in (I \cup J)$. Given the Dixit-Stiglitz aggregation of varieties each firm produces a quantity

$Q_r^g(N_r^g)^{\sigma_F^g/(1-\sigma_F^g)}$. Assuming that fixed and variable costs are satisfied using the same input technology, and a firm-level fixed cost of f_r^g (in composite input units), we have the zero profit condition

$$f_r^g - \frac{Q_r^g(N_r^g)^{\sigma_F^g/(1-\sigma_F^g)}}{\sigma_F^g - 1} = 0 \quad \forall g \in (I \cup J). \quad (5)$$

The technologies for producing the composite inputs for use in the Dixit-Stiglitz sectors depend on the type of sector. For all of the sectors there is a sector-specific capital input from the respective source region. Let $PZ_r^g \forall g \in (I \cup J)$ be the price of this sector-specific capital input. Domestic firms (producing goods or services) use domestic inputs, so the unit cost function is given by

$$PMC_r^g = \left[\theta_{Zr}^g (PZ_r^g)^{1-\epsilon_r^g} + \theta_{Dr}^g (PD^g)^{1-\epsilon_r^g} \right]^{1/(1-\epsilon_r^g)}, \quad \text{for } r = D; \quad (6)$$

where ϵ_r^g is the elasticity of substitution between the sector-specific capital input and other inputs, and the θ 's are the CES distribution parameters. Imports of Dixit-Stiglitz goods embody the gross of tariff imported inputs:

$$PMC_r^j = \left[\theta_{Zr}^j (PZ_r^j)^{1-\epsilon_r^j} + \theta_{Mr}^j (PM_r^j)^{1-\epsilon_r^j} \right]^{1/(1-\epsilon_r^j)}, \quad \text{for } r \neq D. \quad (7)$$

FDI firms, on the other hand, use domestic inputs as well as a specialized imported service from the sources region. The price of the specialized imports equals the price of foreign exchange (denoted PFX) times one plus the tariff rate (denoted t_r^i). The unit cost for FDI firms is thus given by the following:

$$PMC_r^i = \left[\theta_{Zr}^i (PZ_r^i)^{1-\epsilon_r^i} + (\theta_{Dr}^i PD^i + \theta_{Mr}^i (1 + t_r^i) PFX)^{1-\epsilon_r^i} \right]^{1/(1-\epsilon_r^i)}, \quad \text{for } r \neq D. \quad (8)$$

For the CRTS sectors and upstream of the IRTS technologies, we have domestic production in accordance with the input output data. Denote the price of this output PY^s , for $s \in G$. The technology includes an upstream Cobb-Douglas value-added nest which then combines with intermediates (trading at PA^g) in fixed proportions. Let PF_f indicate the price of primary factor of production $f \in F$. The unit cost function is given by

$$PY^s = \beta_{VA}^s \prod_f PF_f^{\alpha_f^s} + \sum_g \beta_g^s PA^g \quad (9)$$

where the β are distribution parameters and α are value shares within the value-added nest ($\sum_f \alpha_f^s = 1 \forall s$).

For the CRTS sectors a constant elasticity of transformation (CET) activity splits domestic output (with a unit value PY^k) into goods destined for domestic versus the region-specific export markets. Let the export price (for goods destined for region $r \neq D$) be PX_r^k then the CET technology is given by

$$\left[\gamma_D^k (PD^k)^{1+\sigma_\tau} + \sum_{r \neq D} \gamma_r^k (PX_r^k)^{1+\sigma_\tau} \right]^{1/(1+\sigma_\tau)} = PY^k, \quad (10)$$

where σ_τ indicates the elasticity of transformation and the γ are the CET distribution parameters. In the case of IRTS sectors, we assume that domestic firms use domestic output to produce Dixit-Stiglitz varieties. Thus the CET technology collapses without export coefficients [$\gamma_r^g = 0 \forall g \in (I \cup J)$]:

$$PD^g = PY^g \quad \forall g \in (I \cup J). \quad (11)$$

For CRTS sectors the export commodity is traded for foreign exchange at a fixed rate. Let PFX equal the price of foreign exchange, and with a choice of units such that all unit export prices are one at the benchmark, we have the following specification for the CRTS

export activities:

$$PFX = PX_r^k \text{ for } r \neq D. \quad (12)$$

For the IRTS sectors, domestic firms export the firm-level good where foreign agents are assumed to behave according to Dixit-Stiglitz preferences that are the same as domestic agents. Domestic IRTS firms face an export demand elasticity for their variety of σ_F^g and thus price their exports using the optimal markup. In aggregate the IRTS export activities by region are characterized by

$$EX_r^g = \xi_r^g \left[\left(1 - \frac{1}{\sigma_F^g} \right) \frac{PFX}{PMC_D^g} \right]^{\sigma_F^g} \quad \forall g \in (I \cup J) \text{ and } r \neq D. \quad (13)$$

Cross-border imports are purchased at the price of foreign exchange times one plus the tariff rate, which sets up the arbitrage condition for each import activity;

$$PM_r^g = (1 + t_r^g)PFX \text{ for } r \neq D. \quad (14)$$

Final demand includes three categories: household demand, government demand, and investment. The representative agents for each household h are assumed to have identical Cobb-Douglas preferences over the aggregated goods and services. The preferences are specified via a unit expenditure function associated with an economy-wide utility index (U). Let PC be the true-cost-of-living index indicated by the following unit expenditure function:

$$PC = \prod_g (PA^g)^{\mu_C^g}, \quad (15)$$

where the μ are value shares. The government faces a Leontief price index, PG , for

government purchases:

$$PG = \sum_g \mu_G^g (PA^g). \quad (16)$$

Similarly the price of investment, $PINV$ is a Leontief aggregation of commodity purchases:

$$PINV = \sum_g \mu_{INV}^g (PA^g). \quad (17)$$

Equations (1) through (17) define all of the transformation technologies for the model.

Next we turn to a specification of the market clearance conditions for each price.

2 Market clearance conditions

For each good or service there is a market, and, for any non-zero equilibrium price, supply will equal demand. We will use the convention of equating supply, on the left-hand side, to demand, on the right-hand side. The unit-value functions presented above are quite useful in deriving the appropriate compensated demand functions, by the envelope theorem (Shephard's Lemma).

Supply of the composite goods and services, trading at PA^g , is given by the activity level, A^g , and demand is derived from each production or final demand activity that uses the good or service. The market clearance condition is given by

$$A^g = \sum_s \beta_g^s Y^s + \mu_C^g U \frac{PC}{PA^g} + \mu_G^g PUB + \mu_{INV}^g INV \quad (18)$$

For the IRTS sectors we have market clearance for the Dixit-Stiglitz regional composites:

$$Q_r^g = A^g \left(\frac{(1 - ts^g) PA^g}{P_r^g} \right)^{\sigma_F^g} \forall g \in (I \cup J), \text{ for } r \neq D; \quad (19)$$

and for domestic firms we include demand for the Dixit-Stiglitz exports

$$Q_D^g = A^g \left(\frac{(1 - ts^g)PA^g}{P_D^g} \right)^{\sigma_F^g} + \sum_r EX_r^g \quad \forall g \in (I \cup J). \quad (20)$$

The IRTS composite input (trading at PMC_r^g) is supplied by an activity, denoted $Z_r^g \forall g \in (I \cup J)$, and is demanded by the firms:

$$Z_r^g = f_r^g N_r^g + Q_r^g (N_r^g)^{1/(1-\sigma_F^g)} \quad \forall g \in (I \cup J). \quad (21)$$

To derive (21) recall that firm-level output is $Q_r^g (N_r^g)^{\sigma_F^g/(1-\sigma_F^g)}$ so the use of the input across all firms is $Q_r^g (N_r^g)^{1/(1-\sigma_F^g)}$ plus the total input use on fixed costs, $f_r^g N_r^g$.

Market clearance for the domestic output of CRTS sectors depends on supply from the CET activity and demand from the Armington activity:

$$\gamma_D^k X^k \left(\frac{PD^k}{PY^k} \right)^{\sigma_\tau} = \phi_D^k A^k \left(\frac{(1 - ts^k)PA^k}{PD^k} \right)^{\sigma_{DM}^k}. \quad (22)$$

For IRTS sectors, supply is simply given by the CET activity (as there are no export coefficients in the CET technology for IRTS sectors). Output is then demanded by either the domestic or FDI firms. The market clearance conditions are given by

$$X^i = \theta_{DD}^i Z_D^i \left(\frac{PMC_D^i}{PD^i} \right)^{\epsilon_D^i} + \sum_{r \neq D} \theta_{Dr}^i Z_r^i \left(\frac{PMC_r^i}{\theta_{Dr}^i PD^i + \theta_{Mr}^i (1 + t_r^i) PFX} \right)^{\epsilon_r^i} \quad (23)$$

for the service sectors, and

$$X^j = \theta_{DD}^j Z_D^j \left(\frac{PMC_D^j}{PD^j} \right)^{\epsilon_D^j} \quad (24)$$

for the Dixit-Stiglitz goods sectors.

Market clearance for exports of CRTS output is given by the CET supply function and demand is given by the export activity level (export demand is perfectly elastic):

$$\gamma_r^k X^k \left(\frac{PX_r^k}{PY^k} \right)^{\sigma_\tau} = EX_r^k, \quad \text{for } r \neq D. \quad (25)$$

Reconciling gross output with the CET activities, we have market clearance for the commodities that trade at PY^g :

$$Y^g = X^g. \quad (26)$$

Import supply is perfectly elastic and import demand is derived from the Armington activities or embodied in the foreign Dixit-Stiglitz firm's inputs. For $r \neq D$, we have the following:

$$IM_r^i = \phi_r^i A^i \left(\frac{(1 - ts^i) PA^i}{PM_r^i} \right)^{\sigma_F^i} \quad (27)$$

$$IM_r^j = \theta_{Mr}^j Z_r^j \left(\frac{PMC_r^j}{PM_r^j} \right)^{\epsilon_r^j} \quad (28)$$

$$IM_r^k = \phi_r^k A^k \left(\frac{(1 - ts^k) PA^k}{PM_r^k} \right)^{\sigma_{DM}^k}. \quad (29)$$

Factor markets clear, where factor supply is given by the exogenous endowments to households, denoted \bar{S}_{fh} , and input demands are derived from the cost functions:

$$\sum_h \bar{S}_{fh} = \sum_s \alpha_f^s Y^s \left(\frac{PY^s - \sum_g \beta_g^s PA^g}{PF_f} \right). \quad (30)$$

In addition, we have the market for the specific factor used in the IRTS sectors. Denoting

the regional endowments of the specific factors $\overline{SF}_r^g \ \forall g \in (I \cup J)$, we have:

$$\overline{SF}_r^g = \theta_{Z_r}^g Z_r^g \left(\frac{PMC_r^g}{PZ_r^g} \right)^{\epsilon_r^g} \quad \forall g \in (I \cup J). \quad (31)$$

Real investment equals real savings by households, enterprises, the government, and indirect foreign investment:

$$INV = \sum_h \overline{sav}_h + \overline{sav}_{ent} + \overline{sav}_G + \overline{sav}_{row}. \quad (32)$$

Real government purchases equal the nominal government budget scaled by the government price index:

$$PUB = \frac{GOVT}{PG}. \quad (33)$$

Enterprises earn net income of ENT , other agents (households, the government, and foreign entrepreneurs) own claims to this income. We set up the transfer of income as a market clearance condition for claims, which trade at a price PE . The claims are indicated by the $\bar{\zeta}$ coefficients and these are serviced by net enterprise income scaled by the price of the claims:

$$\sum_h \bar{\zeta}_h + \bar{\zeta}_{gov} + \bar{\zeta}_{FE} = \frac{ENT}{PE}. \quad (34)$$

Thus the nominal value of enterprise income transferred to households, the government, and foreign entrepreneurs equals ENT .

Household utility (U) equals nominal income across households scaled by the true-cost-of-living index. That is, we represent an aggregate activity U , which supplies *utils* to the households. For the representative agent of household type h denote nominal income

RA_h . The market clearance condition for *utils* is thus

$$U = \frac{\sum_h RA_h}{PC}. \quad (35)$$

The final market clearance condition reconciles the balance of payments. The supply of foreign exchange includes its generation in the export activities and net borrowing from the rest of the world (net capital account surpluses). The real capital account surplus includes an endogenous component, denoted KA , and an exogenous residual transfer (from foreigners to the domestic government), denoted \overline{ftrn} . Foreign exchange is demanded for direct import purchases as well as the payments to foreign agents for their contribution to production.

$$\begin{aligned} \sum_{r \neq D} \sum_g EX_r^g + (KA + \overline{ftrn}) &= \sum_{r \neq D} \sum_g IM_r^g \\ &+ \sum_{r \neq D} \sum_i \theta_{Mr}^i Z_r^i \left(\frac{PMC_r^i}{\theta_{Dr}^i PD^i + \theta_{Mr}^i (1 + t_r^i) PFX} \right)^{\epsilon_r^i} \\ &+ \frac{FE}{PFX}, \end{aligned} \quad (36)$$

where FE equals the nominal claims that the foreign entrepreneurs have on specific factor rents and enterprise income.

3 Income Balance Conditions

The representative agent for household h earns income from factor endowments and claims on enterprise income, but disposable income nets out savings and direct taxes. Real savings is held fixed (by the coefficient \overline{sav}_h). We also hold fixed the real level of government spending, but this requires an adjustment in direct taxes on households. Removal of tariffs, for example, impact the government budget and the shortfall is made up for by an

endogenous increase in the direct taxes on households. We use the auxiliary variable T to scale the direct taxes appropriately. Household h 's budget is given by

$$\begin{aligned}
RA_h &= \sum_f PF_f \bar{S}_{fh} \\
&+ \bar{\zeta}_h PE \\
&- \bar{sav}_h PINV \\
&- \overline{dta}x_h PG \times T
\end{aligned} \tag{37}$$

The government budget is given by direct taxes, sales taxes, tariff revenues, and claims on enterprise income. The government budget also captures the capital account balance and its conversion to investment by foreign agents.² In addition, the government's budget is augmented by foreign transfers of foreign exchange and reduced by direct public savings. The full nominal government budget is

$$\begin{aligned}
GOVT &= \overline{dta}x_h PG \times T \\
&+ \overline{dta}x_{ent} PG \\
&+ \sum_g ts^g PA^g A^g \\
&+ \sum_{r \neq D} \sum_g t_r^g (PFX) IM_r^g \\
&+ \sum_{r \neq D} \sum_i t_r^i (PFX) \theta_{Mr}^i Z_r^i \left(\frac{PMC_r^i}{\theta_{Dr}^i PD^i + \theta_{Mr}^i (1 + t_r^i) PFX} \right)^{\epsilon_r^i} \\
&+ \bar{\zeta}_{gov} PE \\
&+ (PFX) KA - \bar{sav}_{row} PINV \\
&+ \overline{ftrn} PFX
\end{aligned}$$

²Nominal government income is increased by $(PFX)KA$ but this is offset by nominal investments of $(\bar{sav}_{row})PINV$. Equation (42) is added to the equilibrium system to ensure that the nominal value of capital inflows equals the nominal investment by the modeled government agent acting on behalf of the foreign investors.

$$- \overline{sav}_G PINV \quad (38)$$

Again, the index T is adjusted endogenously to hold the real level of public spending fixed.

We now turn to enterprise income. Enterprises earn income on the domestic specific factors. Real spending by enterprises on direct taxes and savings are held fixed. The net income is then available to be transferred to one of the agents [via equation (34)]. Enterprise income is given by

$$\begin{aligned} ENT &= \sum_g PZ_D^g \overline{SF}_D^g \\ &- \overline{sav}_{ent} PINV \\ &- \overline{dtax}_{ent} PG \end{aligned} \quad (39)$$

We also need an agent representing the foreign entrepreneur. The foreign entrepreneur's nominal income is FE , which is spent on foreign exchange, and consists of the specific factor payments and the distributed enterprise payments:

$$FE = \sum_{r \neq D} \sum_g PZ_r^g \overline{SF}_r^g + \overline{\zeta}_{FE} PE \quad (40)$$

4 Auxiliary Conditions

In addition to the three sets of standard conditions presented above, we need to close the model with a couple of auxiliary conditions. First, we need to determine the index on direct taxes of households. Associated with the variable T is the following condition:

$$PUB = \overline{pb}. \quad (41)$$

This holds fixed the real size of the government at the exogenous level \overline{pb} . Lastly, we reconcile relative price changes that affect capital flows. Foreign agents interested in investing in Kenya will consider the relative price of investment to the price of foreign exchange. Associated with the variable KA is the following condition:

$$(PFX)KA = (\overline{sav}_{row})PINV. \quad (42)$$

From the perspective of the foreign agent, real indirect investment in Kenya is held fixed, and the term $[(PFX)KA - \overline{sav}_{row}PINV]$ drops out of the government budget.

Equations (1) through (42) define the general equilibrium simulation model of Kenya. The fuctions are calibrated to the social accounts, such that the social accounts are replicated in the benchmark solution.

References

Balistreri, Edward J., Thomas F. Rutherford, and David G. Tarr (2009) ‘Modeling services liberalization: The case of Kenya.’ *Economic Modelling* 26(3), 668–679

Appendix G:

A note on the relationship between sector specific capital and the elasticity of supply in applied general equilibrium models of imperfect competition*

Edward J. Balistreri
Colorado School of Mines

David G. Tarr
The World Bank

June 2, 2010

The models developed by Balistreri et al. (2009) and Jensen et al. (2008) to analyze services liberalization in Kenya and Tanzania utilize a specific-factor formulation. The specific-factor formulation facilitates a calibration of the FDI and domestic service responses. This is important because the empirical evidence [Hummels and Klenow (2005)] indicates that varieties expand less than proportionately to market size. The expansion of services bids up the price of the specific factor resulting in increasing costs (upward sloping supply). These increasing costs ensure that the varieties expand less than proportionately to market size. The predetermined elasticity of supply controls the magnitude of these effects. This note outlines the calibration procedure.

One can calibrate a linearly-homogeneous (constant-returns) Constant Elasticity of Substitution (CES) technology to an arbitrary price elasticity of supply if some of the input value is allocated to a specific factor. In the context of the Kenyan and Tanzania models the supply elasticity applies to the composite input that is used in both fixed and variable costs associated with the services sectors.

To simplify the presentation, consider the composite input for a single type of firm (say domestic firms) and for a single industry (say Communications). Let the quantity of this

*This note is largely based on lecture notes from Thomas F. Rutherford's graduate course on Computational Economics at the University of Colorado (late 1990's)

composite input be denoted y with a market price of p . Denote the associated nested CES unit cost function $c(\vec{r})$, where \vec{r} is a vector of input prices. With competition for the composite input we have

$$p = c(\vec{r}) \equiv \min \{ \vec{r}' \vec{x} \text{ s.t. } f(\vec{x}) = 1 \}, \quad (1)$$

where \vec{x} is the vector of inputs and the function, $y = f(\vec{x})$, is the CES technology for aggregating inputs. Denote the fixed quantity of the sector specific input \bar{R} with price r_1 , and assume that all of the mobile inputs can be combined into a separable composite X with composite price r_2 (that is, $\vec{x} = \{\bar{R}, X\}$ and $\vec{r} = \{r_1, r_2\}$).¹ We thus have the explicit expression:

$$p = c(r_1, r_2) \equiv \min \left\{ r_1 \bar{R} + r_2 X \text{ s.t. } [\alpha_R \bar{R}^\rho + \alpha_X X^\rho]^{1/\rho} = 1 \right\}, \quad (2)$$

where ρ indicates the elasticity of substitution, $\sigma = 1/(1 - \rho)$, and α_R and α_X are the CES distribution parameters. Choosing units carefully (such that $p = r_1 = r_2 = 1$) at the benchmark and solving (2) we have the unit cost function:

$$c(r_1, r_2) = \left[\theta r_1^{1-\sigma} + (1 - \theta) r_2^{1-\sigma} \right]^{\frac{1}{1-\sigma}}, \quad (3)$$

where θ is the benchmark value share of the sector specific input. Given that the quantity \bar{R} is fixed in supply the price r_1 is a residual. The technology *de facto* exhibits decreasing returns (upward sloping supply) because the only way to increase y is to increase X at

¹The variable X is a nested CES subcomposite of all of the inputs excluding \bar{R} . Define \vec{z} as the vector of all inputs other than \bar{R} , and define \vec{s} as the vector of corresponding input prices. Let $X = g(\vec{z})$, so we have $r_2 = \min \{ \vec{s}' \vec{z} \text{ s.t. } g(\vec{z}) = 1 \}$, where $g(\vec{z})$ is a nested CES function and the input vector \vec{z} may include intermediates. The actual specification of $g(\vec{z})$ is not a concern here because the supply elasticity is inherently dependent on the concept of partial differentiation (changes in the elements in \vec{s} are not considered). In fact, we are only concerned with the supply elasticity local to the benchmark equilibrium, where r_2 takes on a specific numeric value.

diminishing marginal product (as the \bar{R} to X ratio falls).

Using Shepard's lemma to derive demand for \bar{R} we can represent the overall resource constraint on the specific factor as follows:

$$\begin{aligned}\bar{R} &= y \frac{\partial c(\vec{r})}{\partial r_1} \\ &= \theta y \left(\frac{p}{r_1} \right)^\sigma.\end{aligned}\tag{4}$$

Solving for the residual price

$$r_1 = p \left(\frac{\theta y}{\bar{R}} \right)^{1/\sigma},\tag{5}$$

and then substituting this back into the unit cost function we have:

$$p^{1-\sigma} = \theta p^{1-\sigma} \left(\frac{\theta y}{\bar{R}} \right)^{\frac{1-\sigma}{\sigma}} + (1-\theta) r_2^{1-\sigma}.\tag{6}$$

Solving for y as a function of the resource constraint and the price ratio (r_2/p) we have supply:

$$y = \bar{R} \theta^{\frac{1}{\sigma-1}} \left[1 - (1-\theta) \left(\frac{r_2}{p} \right)^{1-\sigma} \right]^{\frac{\sigma}{1-\sigma}}.\tag{7}$$

The supply elasticity is given by

$$\eta \equiv \frac{\partial y}{\partial p} \frac{p}{y} = \frac{\sigma(1-\theta)}{-1 + \theta + \left(\frac{r_2}{p} \right)^{\sigma-1}},\tag{8}$$

and evaluating this local to the benchmark equilibrium ($r_2 = p = 1$) we have

$$\eta = \frac{\sigma(1-\theta)}{\theta}.\tag{9}$$

This equation gives us the fundamental relationship between the local supply elasticity and the CES parameters.

Notice that there are many combinations of value shares and substitution elasticities that yield the same local supply elasticity. If the goal is to calibrate the model to a given value of η there are a couple of options. For example, one could simply lock down the value of σ (at say $\sigma = 1$, which is Cobb-Douglas) and then calculate the appropriate overall value share of the specific factor (at $\sigma = 1$ we have $\theta = 1/(1 + \eta)$). In empirical applications, however, this calibration method can be problematic, because the value of θ may be constrained by the social accounts.

In the Kenya and Tanzania models we choose a different calibration strategy. We observe the value of capital payments in the social accounts, and it is logical that these include payments to the specific factor. Denote the observed capital payments \mathcal{K} and the overall value of output \mathcal{Y} . Now if we choose a share of the capital payments that should be allocated to the specific factor, call this θ_k , we can calculate the appropriate elasticity of substitution as follows:

$$\sigma = \frac{\eta\theta}{1 - \theta}, \quad (10)$$

where $\theta = \theta_k(\mathcal{K}/\mathcal{Y})$.

In sensitivity analysis on the Kenya and Tanzania models we hold fixed the value of $\theta_k = 0.5$ and vary the value of η . As η increases the calibrated elasticity of substitution increases and we observe a more elastic supply response. In terms of varieties, we observe that the change in the number of varieties is closer to proportional to the change in market size as η increases.

One might consider sensitivity analysis on the value of θ_k , but this will not necessarily generate intuitive responses. In fact, as long as the counterfactual is local to the benchmark equilibrium there should be no effect of changing θ_k . As θ_k increases the value of $\theta/(1 - \theta)$ falls and, according to equation (10), the calibrated value of σ falls to compensate. So larger value shares will not necessarily generate larger supply responses. In fact, by design, the

local impact of a change in θ_k is zero.

References

- Balistreri, Edward J., Thomas F. Rutherford, and David G. Tarr (2009) ‘Modeling services liberalization: The case of Kenya.’ *Economic Modelling* 26(3), 668–679
- Hummels, David, and Peter Klenow (2005) ‘The variety and quality of a nation’s trade.’ *American Economic Review* 95(3), 704–723
- Jensen, Jesper, Thomas F. Rutherford, and David G. Tarr (2008) ‘Modeling services liberalization: The case of Tanzania.’ *Policy Research Working Paper*, No. 4801, The World Bank